Learning Science Through Environment

A Textbook for Primary Schools
(Class V)

National Council of Educational Research and Training

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Foreword

This book for Class V is based on "The Curriculum for the Ten-year School: A Framework" and "Report of the Review Committee on Curriculum for the Ten-year School", which envisage science education at the primary stage as environmental studies.

The title of the book "Learning Science Through Environment" explicitly reflects the philosophy of this approach. Science education at this stage is based not on the principles of science as the focal point but on an understanding of the environment and its problems through the scientific method. The chapter headings in the book reflect the elements in the environment on which learning is based.

It is hoped that this shift in emphasis will make it possible to relate scientific knowledge to the real life of the pupils. Throughout the book, the emphasis is on 'pupils' participation in the learning activities, which are so designed that there is no need for special equipment. The environment itself becomes a learning resource. The simple science processes of observation, measurement, classification, and communication can be developed through these activities. Thus, the learning of both the product and the process of science may be achieved.

The manuscript of this book was prepared by a team of experts in environmental studies in the Department of Education in Science and Mathematics and was reviewed in a workshop by primary school teachers and subject experts. The work of all the persons involved in bringing out this book is gratefully acknowledged. Any suggestions for the improvement of this book will be highly appreciated.

SHIB K. MITRA
Director
National Council of Educational
Research and Training

New Delhi
March 1979

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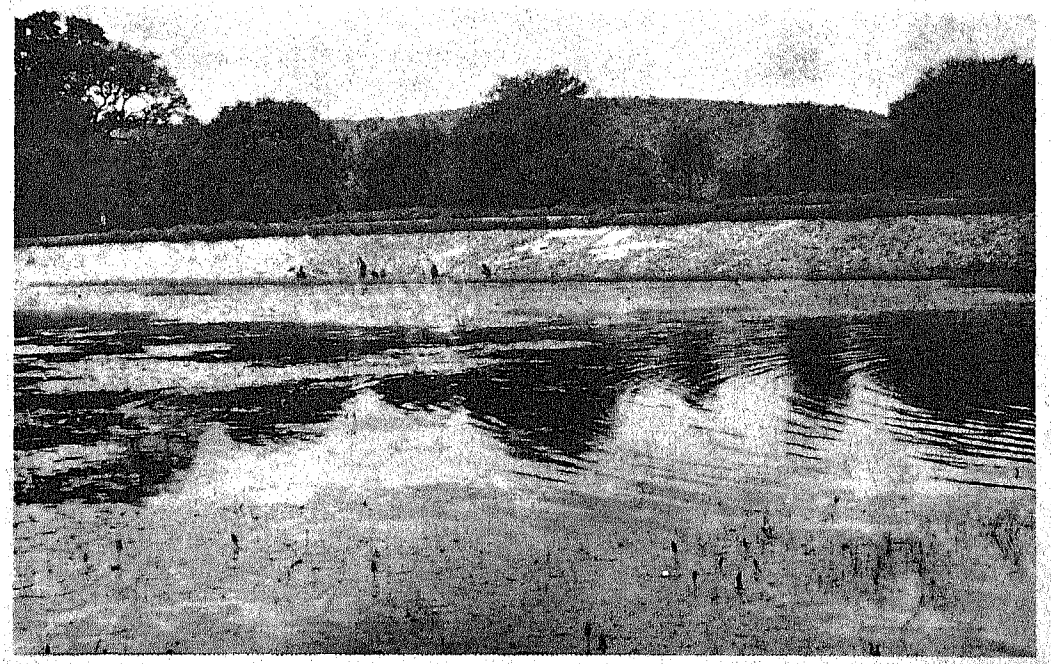
CHAPTER ONE

Living Things



You might have seen a pond around your village or town. There may also be smaller areas of shallow land in which the water collects during the rainy season and stays there for several months.

In all such ponds or ditches, you may see some plants and animals. What are these?

Let us find out

Stop near a pond one day. Do you see any water hyacinth, water cabbage or lily plants? Do you see any free floating plants on the water surface? Do you see any green fibre-like materials? Collect some floating plants from the surface of water in a glass bottle or a tin container. You may

also bring some plants which are completely submerged in water. Bring them to the school and examine carefully. Then answer the following questions:

1. Do the free floating plants have long stems as those on the land?
2. Are the stems and roots as rigid or strong as the land plants?
3. Are the submerged parts of the water plants as hard as the stalks of leaves of some land plants you know?

For the above comparisons of land plants and water plants you may examine a common land plant from outside. If there is no pond nearby, request your teacher to bring some water plants for you. Ask your teacher why some plants in the pond float on water.

Why are the roots and stems of the water plants softer than those of the land plants?

Let us find out

Press between your fingers the thick soft stem or the leaf stalks of some water plants that you have collected. While pressing keep it submerged in water. Do you see any bubbles coming out? These are the bubbles of air. Air makes the stems and leaves float. Also note that it is easier to press a water plant between fingers than the stem or stalk of a land plant.

Why are the land plants harder than the water plants?

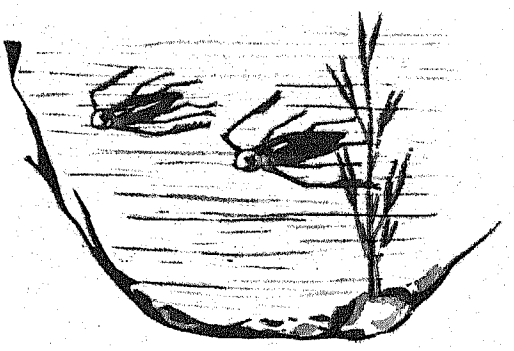
Let us discuss

The land plants take up water from the ground through their roots. They have fine tubes which carry water to the leaves. There must also be greater strength in their stems to keep them erect and upright. This is possible because of the hard fibres present in them. The water plants take up water through those parts which are submerged in water. Different parts of water plants are, therefore, softer than those of land plants.

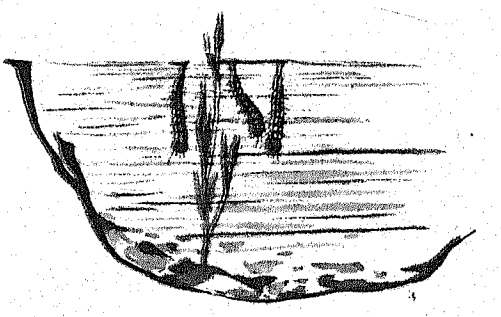
What are the types of animals or insects found in the pond?

Let us observe

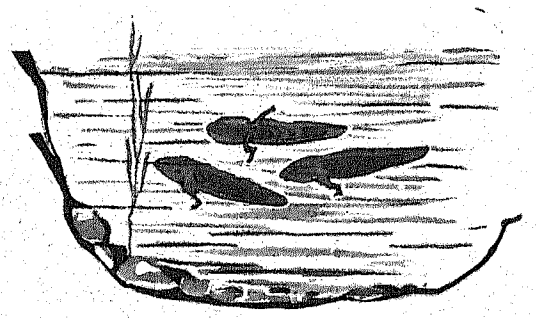
Look carefully into the pond along its sides. You may see many interesting insects and animals. Do you see any water-boatman with long paddle-like legs? These legs help in swimming. Think if these or other water insects can fly. You are all very familiar with fishes. They cannot breathe if taken out of water and, therefore, die. You



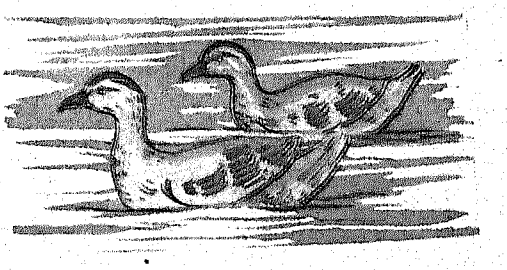
may also see some tadpoles which swim freely in water in the rainy season. Without disturbing the tadpoles,



Are these ducks, cranes, geese, swans or some other birds? Can a crow or a parrot swim in the same way? Also



look at them every two or three days. See how they change into small toads in a matter of days. Observe more closely in areas where water gets collected and remains there for several days. You may see some small mosquito larvae hanging upside down from the water surface. They soon change as adult mosquitoes. In the pond you also see some birds which walk on mud or swim easily in water.



observe long necks, long legs and long beaks of some of the water birds. Further observe the beaks of other birds in your surroundings. These may be parrots, mynahs, vultures or pigeons. Draw them as accurately as you can. What do you learn from these observations?

Let us discuss

Discuss among yourselves and with your teacher how some birds can swim while others cannot, and how tadpoles change into toads and mosquito larvae into mosquitoes. Also

discuss the shape of beaks of birds in relation to what they eat and how they catch or pick up food.

Let us keep records

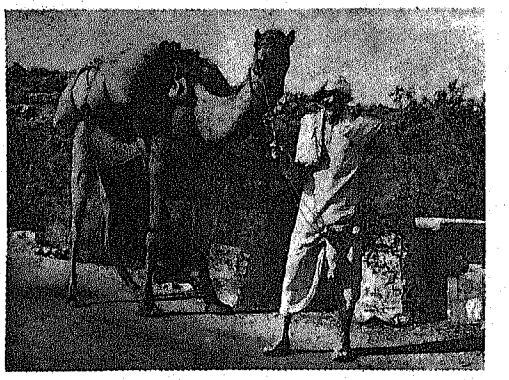
Draw the plants and animals studied by you in your note-book. Write down their names. Note down your observations on the differences between water plants and land plants; between water insects, water birds and those living on land.

Some plants and animals have water all around them, like those in ponds, lakes, rivers or seas. Others, like those of deserts or other dry areas, get very little water. If you live in a desert-like or a dry area, you can see a variety of these plants and animals. You may also go to slopes of rocky hills to see some of them. But even in areas of plenty of rains, you see some plants and animals which use little water.

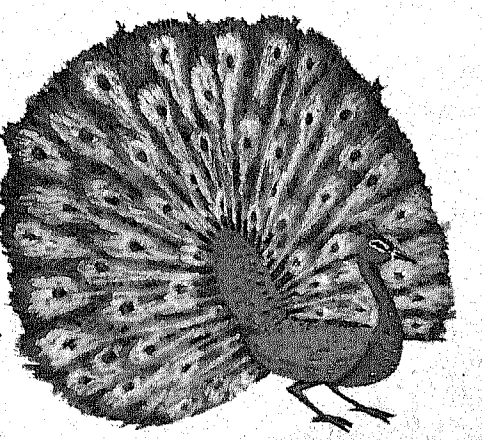
What are the animals and plants that are found in a desert?

Let us discuss

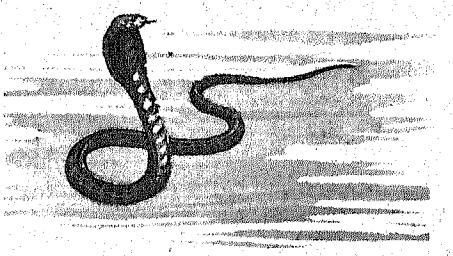
Your teacher may tell you about some of the animals found in the Thar desert of Rajasthan. The camel is one. This animal is specially suited to life of the desert. It can go without water for many days. It helps to carry



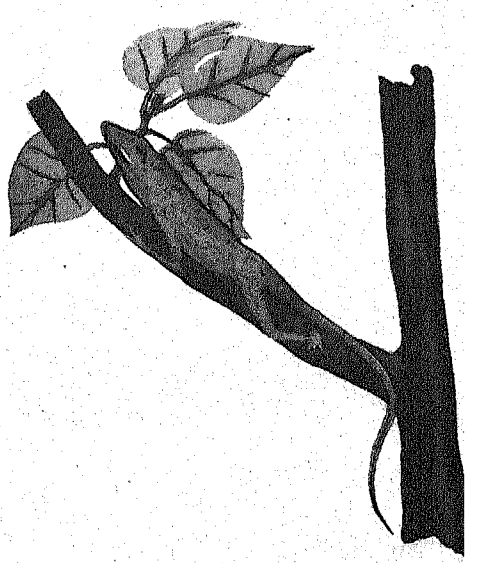
men and materials in deserts where other animals cannot live. Many colourful lizards, snakes and spiders are also found in deserts. Peacock,



our national bird, is commonly found



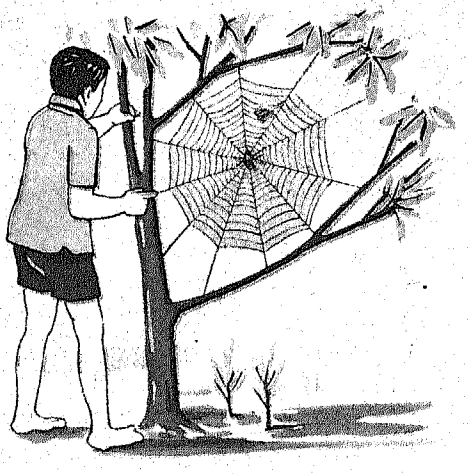
in deserts. A large variety of fleshy plants, known as *cacti* which store a lot of water, are found in desert. Their stems are fleshy and watery and leaves are in the form of needles. Dry areas also have many thorny plants and bushy plants or shrubs.



Can you find some of these plants and animals near your home?

Let us observe

When you are out in a garden or field, look for the garden lizards which have spiny body with green, red or black areas on them. Observe how they catch insects for their food. Beware of snakes; but if you do see one running away, observe its body and how it moves. Spiders are found



every where in houses or trees. See how they make their webs, move along the silk threads and eat up a fly, an insect or a mosquito that gets trapped. Move a small rock, a large flower

pot or a stone slab left in its place for a long time. Watch out! There may be many crawling insects or worms which were hidden.

Take the blade of a wild or potted cactus plant. Cut a piece of the fleshy stem and see how watery it is inside. See the needles on the surface of the flat stem.

If possible go to a zoo where you will see camels, peacocks, snakes, along with many other birds and animals.

Let us keep records

Draw, label the parts and write a brief description of all the plants and animals that you have observed. Mention the peculiarities noted by you.

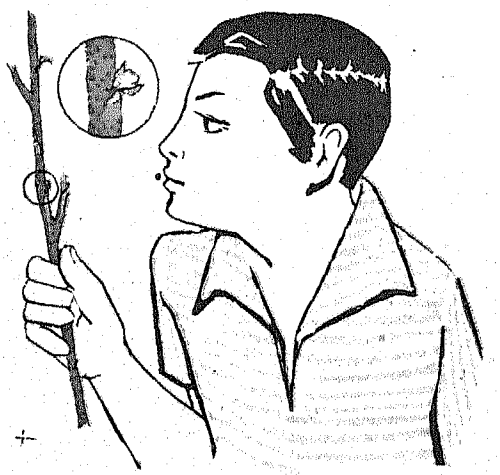
Plants and animals are also found in high Himalayan areas in our country. These also have certain features which enable them to grow or live at such high places in cold winters. What are these features?

Let us discuss

Ask your teacher about the pine, deodar or chir trees which bear green leaves throughout the year. They are not harmed by very cold, snowy winter. Look at the pictures of some

of the trees that grow on high mountains. There may be a *thuja* tree in your school or some garden. It grows on high mountains also. Observe its shape and needle-like leaves.

Some trees at high mountains lose their leaves before the winter sets in. New leaves and branches grow from



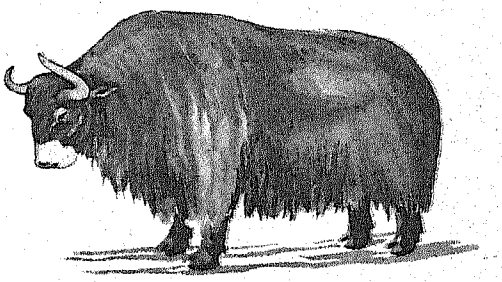
buds during the spring. Look at the branch in the diagram which has lost its leaves during the winter. Note also the buds on the stem.

What are the animals that live in forests of high mountains?

Let us discuss

Bears, yaks and mountain goats, which have thick coat of hair on their body, live comfortably on high mountains. There are many other animals

which live in these places. Most of them have thick coat of skin and hair on their body.



You have studied the plants and animals of various types found at many places. They are different in many ways, yet they share certain features which are common to all living beings.

What are the common features of the living beings?

Let us discuss

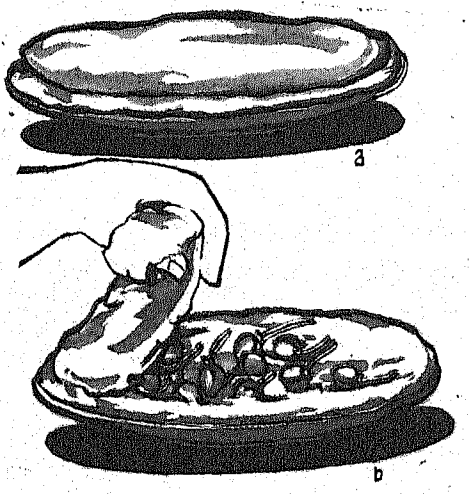
You know how seeds grow into trees, how babies grow into adults, and eggs burst open to release baby birds

which grow into adults and can fly. You have also seen a number of other organisms grow. Discuss how they grow. But plants and animals grow in different ways.

How do plants grow?

Let us find out

Put some seeds of gram, pea or bean



on wet cotton in a dish or some other suitable container. Keep it covered for two to three days. Observe what happens. Do the seeds first swell? Does a new white structure become visible after a while? What is this? Observe how fast it grows. Note also the coming out of other parts. When do the green parts appear?

The white part that comes out first will make the main root. Observe its length every day for three days. You will see that it becomes larger every day. You can say that the seedling is growing. The same is true for other parts of the plants, i.e. stem, leaves, etc.

How can we follow the growth of a plant?

Let us observe

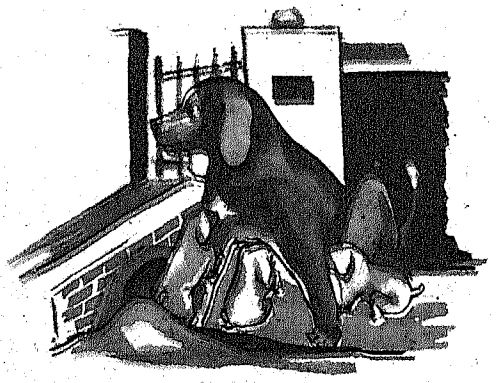
Look at the young plant that comes out in a crop field, in the surroundings of the school or your home. Count the number of leaves once a week on five similar plants. Measure the height of the plant each week. Continue this for a month. Record your observations as follows:

Serial number	*Height of plant in cm* dates	*No. of leaves* dates
1		
2		
3		
4		

Discuss your observations on plant growth with your teacher and friends. You have seen that when plants grow, they keep on giving rise to newer structures such as new leaves, new branches, new flowers and fruits. But is this true for animals also?

Let us discuss

Fully formed kittens, kids or puppies are born to their respective mothers.



They do not develop new organs as they grow. They only grow in size. A small baby bird comes out of an egg. It has all the parts of the body except the feathers which grow slowly. You can break away the parts of a plant and new parts will appear, but the organs of animals, once lost, do not form again.

Do you ever see a rock, a chair, a table, a bed or other non-living things growing?

All plants and animals need energy to remain alive. For energy we eat food. Other animals also eat plants, fruits, grains, worms or other animals.

What happens to the food after it is consumed?

Let us discuss

The food is first digested, i.e. converted into simpler forms. These simpler forms are absorbed in the body. In all living things, energy for doing work comes by further breaking down of the absorbed food. This process of breaking down of food to release energy in living things is called *respiration.*

How do we know that respiration is going on in living things?

Let us find out

Get some lime water from your teacher. Pour its equal amount in two glass tumblers. As you breathe out, let the air go into one of the tumblers through a straw pipe, rubber tube,

hollow stem of some plant or rice straw.

Observe that lime water turns milky in it. Why does it so happen?

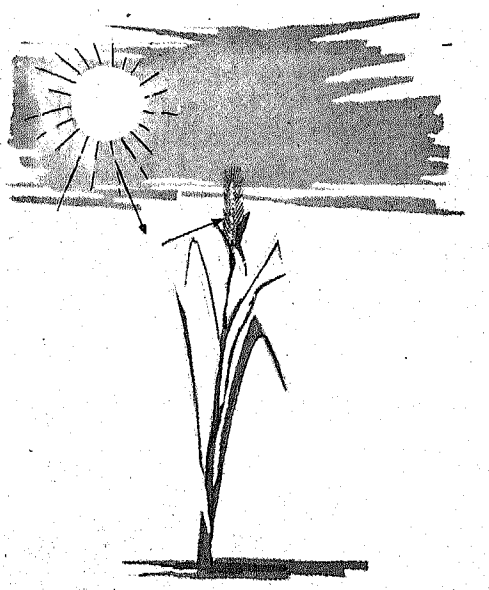
Let us discuss

Lime water turns milky if carbon dioxide is passed through it. The air you breathe into it has more carbon dioxide than the air outside. This carbon dioxide of your breath turns the lime water milky. This shows that carbon dioxide is formed in respiration. It comes out with the air that we breathe out. Breathing, thus, is an indicator of respiration in man and many other animals.

But how do plants respire?

Let us discuss

We do not see plants taking food like animals. Plants have green leaves and other green parts in which they form their own food in the presence of sunlight. In respiration, they consume this very food. Plants also release carbon dioxide in respiration. They do not breathe like us. You will study in higher classes how respiration in plants gives rise to carbon dioxide in the same way as in the case of animals. To study this, you need some equipment.



Do non-living things also respire and release carbon dioxide? Discuss with your teacher.

What happens if you accidentally touch a very hot object? Have you seen some insects moving around a lighted candle or a bulb at night? You tend to close your eyes if a dust particle suddenly goes in them.

These are some examples of responses or reactions to signals or stimuli from outside. There are many more that you may be familiar with. What are they?

Let us find out

Discuss with your teachers and

Animal	*Stimulus*	*Response*
1.		
2.		

friends and list them down in the given table.

But how do plants respond to stimuli?

Let us find out

Germinate some wheat, barley, gram or bean seeds in an earthen pot and keep it in dark. After the seeds germinate, allow them to grow for two to three days in dark. Then keep them near a window and observe after four days. What do you see? Have the seedlings bent towards light coming from the window or away from it? Discuss the experiment with your teacher.

You know now that plants respond to light by bending towards it. You might have observed the opening of some flowers in the early morning and closing during the day; or folding of *Lajwanti* leaves when you touch them. These are only some examples of responses to stimuli in plants.

Do you ever see such responses to stimuli in non-living things? Discuss it in your class.

The living organisms are able to move themselves or their body parts on their own. Movement is another point of difference between plants and animals. Let us know more about it.

Let us discuss

In response to a stimulus, the animals move their body parts or themselves from one place to another. The plants

remain fixed at one place. Because of the ability of the animals to move freely their reactions are quick. The responses in plants are generally slow. Parts of plants often show natural movements. The bending towards light is an example of movement in plants. The opening and closing of flower is another. These are natural movements. Discuss further how these movements in plants and animals differ from those of bicycles, trains, cars or aeroplanes.

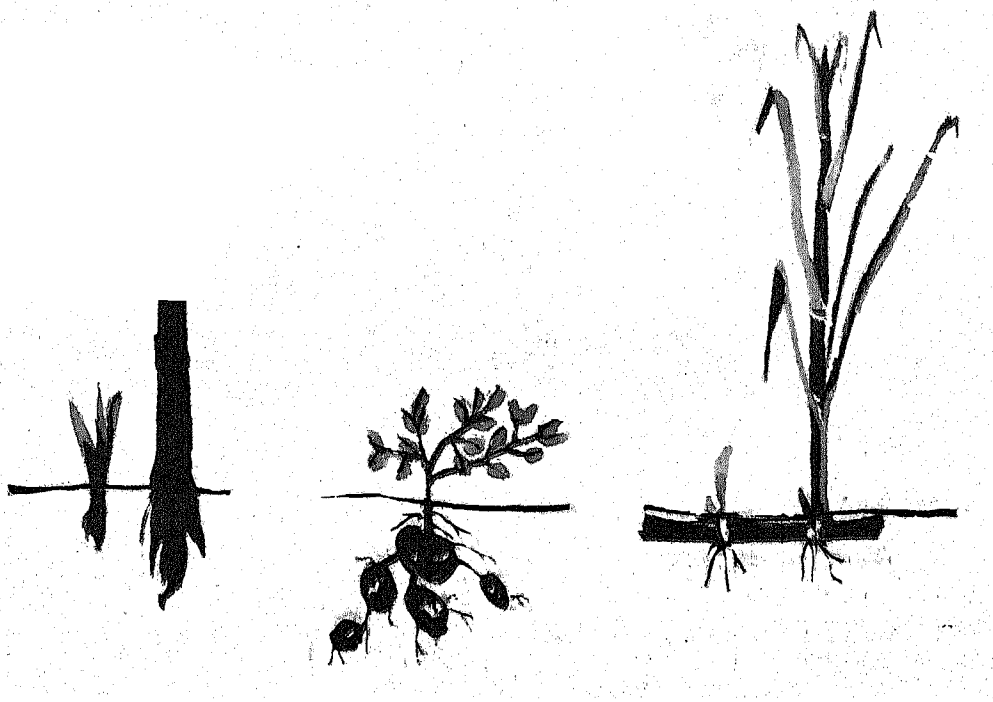
A wheat, rice or maize plant gives a large number of seeds. Each seed germinates to form a new plant, which again bears a large number of seeds. Through this process the living things multiply. Many of the same type are formed from one. This is **reproduction.**

What are some other examples of reproduction?

Let us discuss

A cow gives birth to a number of calves and a cat to many kittens in its life time. A bird gives many eggs from which new birds come out. Discuss further how potato, banana or sugarcane reproduces. Enquire how many seeds were planted in a field of paddy, wheat, bajra etc. and how much was obtained in the end.

People often get sick. So do our



crops. We are given medicine when we are sick. Farmers also give their plants some medicine when they are attacked by diseases. We take medicine through mouth or in the form of injections. Plants are given medicine as sprays or dusts. They absorb these medicines through their leaves. Plant diseases reduce production.

What are some of the diseases of crops?

Let us find out

For this, you have to go to a village farm or an orchard and talk to the farmers. They will tell you about the common diseases of rice, wheat, maize, peas, bhindi, mango, apple, banana, potato, onion or other crops grown in your locality. List the names of the crop, the disease and the related symptoms in the given table.

How are these diseases caused ?

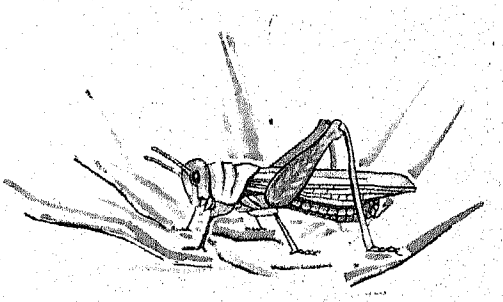
Let us discuss

Ask the farmers if they know what causes these diseases. There are a number of small organisms which cannot be seen but can cause diseases in plants or animals. We can call them **pathogen.** A pathogen is a disease-causing organism.

There are some larger insects also which cause diseases in our crops. What are these?

Let us make a list

1. The swarms of **locusts** that, sometimes, completely destroy our crops. They are large, dark, hopping insects.



2. The caterpillars that you can often see in a cauliflower head, cabbage or spinach (*palak*).

S. No.	*Crop*	*Disease*	*Symptom*
1.	Pea	Powdery Mildew	Powdery covering on the leaf surface
2.	Bhindi	Yellow Vein Mosaic	Yellow and green areas on leaf
⋮			

3. Aphids are small, dark insects which affect oil-seeds crops like mustard and vegetables like cabbage.
4. Many other types such as bugs or borers which damage our crops in many ways. You can enquire about these from farmers.

What do the farmers do to protect their crops against these enemies?

Let us find out

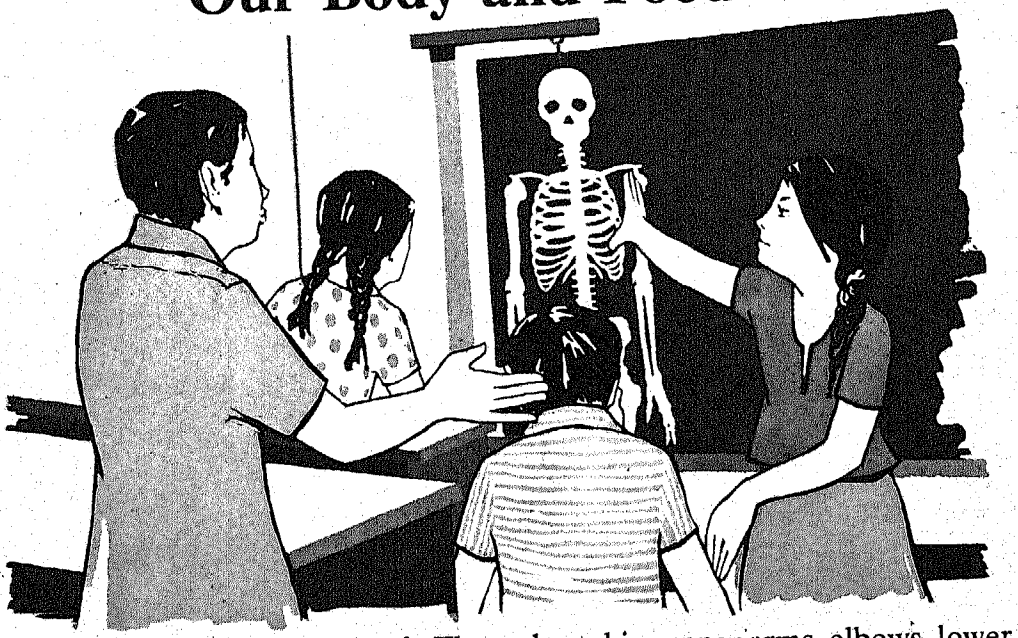
While studying the diseases, ask the farmers about the chemicals they spray or other measures they take against each disease. List the crop, the disease and the medicine in the table given.

Also find out from them if they use seeds of certain crops which are not affected by diseases. Make a note of the name of the variety and the disease which does not attack this particular variety.

S.No.	*Crop*	*Disease*	*Medicine/other treatments*
1.	Potato	Leaf blight	
2.	Brinjal	Stem borer	
3			
4.			
5.			

CHAPTER TWO

Our Body and Food



Most organs of our body are soft. The heart and the lungs, the stomach and the intestines are all soft. You can feel the softness of your muscles. The brain is also soft. These soft organs contain much liquid.

Then why does our body not collapse into a shapeless mass?

Let us find out

Feel your head, shoulders, back chest, hip, upper arms, elbows, lower arms, wrists, fingers, thighs, knees, shins, ankles, toes. Do you feel some hard structures everywhere? These are the bones. These bones form the skeleton of our body. The skeleton is the supporting framework of our body. Without this framework, our body would fall apart.

What are the shapes and sizes of the bones present in our body?

Let us find out

Select a boy of your class. Tell him to remove his shirt. Observe his ribs, collar bone and back bone. You can feel them. What is the shape of ribs of the same size? Is the back bone smooth or knobby? Do you know that it is made up of a large number of small ring-like bones? See the prominent collar bones. What is their shape?

What about the other bones?

See the figure. Observe minutely. There are long bones in the arms and legs, short bones in the fingers and toes. There are flat bones in the head and hips and shoulder blades.

From the top of our head to the tips of our toes, we have 206 bones of different shapes and sizes.

Besides support, in what other ways is the skeleton useful?

Let us discuss

The skeleton helps to give shape to our body. It also protects us from damage. Inside the skull our brain is safe from injury. Our eyes are lodged safely in the sockets of bone. Our heart and lungs are safe in the bony cage formed by the ribs. The back bone protects our spinal cord.

How are our bones joined together?

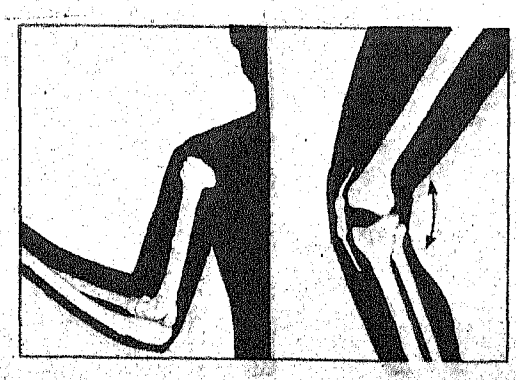
Let us find out

Place your hand on the table. Let your palm face upward. Allow your palm to touch the shoulder region. Do you see that your arm bends at the elbow? Why does it bend? It bends because separate bones support your fore arm and upper arm. The upper arm bone joins the lower arm bones at the elbow. The place where one bone is joined to another is called a joint. Different kinds of joints connect the bones of our skeleton together.

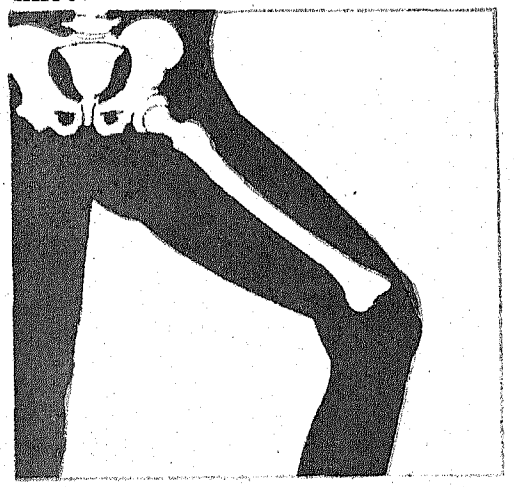
Each kind of joint allows a possible movement. How?

Let us find out

Make your arm straight. Keep it horizontal with your palm upward. Try to bend it at the elbow. Can you do it? The elbow joint allows you to bend your arm upward easily. It does not allow you to bend downward. This



type of joint is called a hinge joint. Such a joint is also present at your knee.

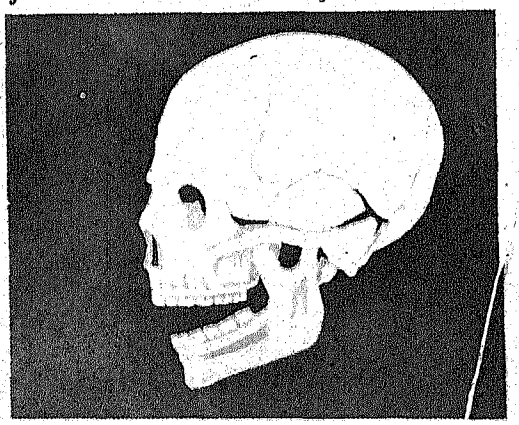


Swing your arms around your shoulder in any direction you like. Likewise swing your leg around the hip. How is it possible? It is because of the ball-and-socket joints in your shoulders and the hips.

Are all joints movable?

Let us find out

See the picture. There are several joints in the skull. They do not move.



The lower jaw is the only bone in the skull that can move. Suppose your lower jaw could not move. In what way it would have affected you ?

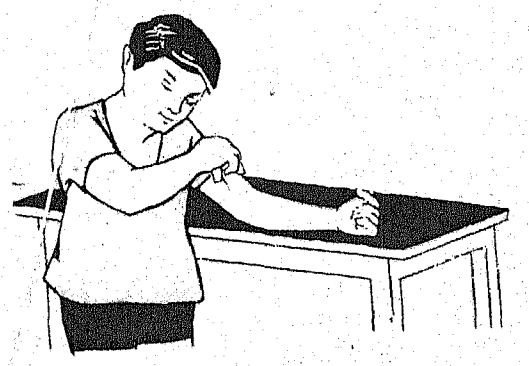
Let us find out

Do not move your jaw. Try to speak. Try to laugh. What happens? How does it affect you?

Joints allow movement of the body. But bones cannot move by themselves. Then how are you able to move?

Let us find out

Place your arm on the table. Keep it relaxed. With your right hand, hold

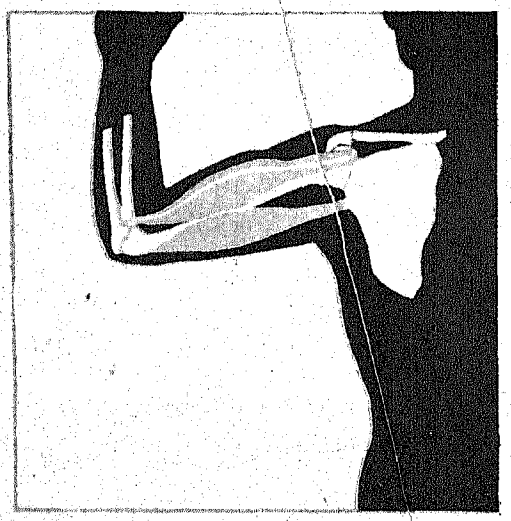


the muscles of the upper arm (biceps) and pull upward. Is the fore arm raised a bit upward ? Why ? The biceps are attached to the bones of the fore arm. So, when the muscles are pulled, the fore arm is raised.

Normally, what action of the muscles makes the fore arm move?

Let us find out

Bend your fore arm. Feel the biceps with the other hand. Do you feel a thickening of the muscles. Straighten the fore arm. Do you feel a thickening



of the muscles at the back of the fore arm (triceps)? Biceps pulled your fore arm up. Triceps pulled it down.

Why are two sets of muscles needed for the movement of the fore arm? Can the same muscles not bend the arm and straighten it? No, muscles are like rubber bands. They can only pull. They cannot push. All the bones of our body are covered with such muscles. They move our bones. Muscles not only move bones, they also pump the heart. They beat the pulse. They move the food from mouth to anus in the digestive tube. They do other work.

Can we stop all our muscle work when we want them to rest?

Let us find out

Try to stop the pumping of your heart. Check if you can do it by feeling your pulse. Can you? Can you stop your digestion? At your will, you can do many things. You can smile. Lower your head. Raise your hands. Open and close your eyes and mouth. But you can neither stop the pumping of your heart nor digestion. Such muscles work automatically. You will not have to think about them. They go on working even when you are asleep. What keeps your heart beating day and night ? How is it made to beat faster or slower ? When you wish to bend your arm, how are your biceps informed about it? Different organs of your body have different functions. But your body works as a

single unit. What controls the working of these organs without your knowledge?

How do these different organs work together?

Let us find out

Sit in pairs. Take a square sheet of paper from a note book. Tear it into several pieces. Put the pieces to-

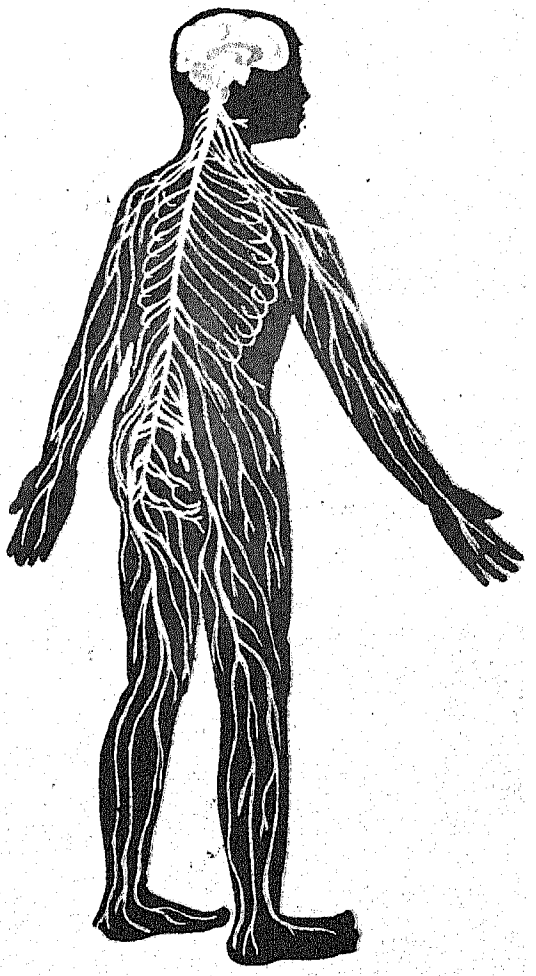
gether to make a square again as in the picture. Can you explain how you could do it?

Your eyes informed your brain about the shapes of the pieces. Your brain sent order to your hand to put the pieces together.

How did your eyes inform the brain? And how did the brain send order?

Let us discuss

Look at the picture. This is the picture of our nervous system. It consists of the brain and a network of nerves. Some nerves carry messages from the



sense organs to the brain. They are called the sensory nerves. Another set of nerves carry messages from the brain to the muscles. They are called the motor nerves. The sensory nerves from the eyes carried the information about the shapes of the pieces of paper to the brain. And your hand received the order from the brain through the motor nerves.

Our brain controls and coordinates all the activities of our body with the help of sensory and motor nerves.

Is not our body wonderful?

To keep our body fit and healthy is our primary duty. How to keep our body fit and healthy? For this, our body needs adequate quantity of good quality food.

What does good quality food mean? And what is the adequate quantity?

Let us discuss

You already know why food is required by our body. Food supplies nutrients. Nutrients are carbohydrates, fats, proteins, minerals and vitamins. Our body needs carbohydrates for energy. Our body needs fats too for energy. Some fats are stored in our body for future use. Our body needs proteins for growth and repair. Minerals and vitamins keep our body healthy and protect it from diseases. Minerals like calcium and phosphorus are needed for strong teeth and bones. Iron is needed for our blood. Vitamins help prevent diseases.

Good quality food is that which supplies all these nutrients required by our body. Observe carefully various kinds of food you eat during the entire day. Record your observations in the following table:

	Daily food chart			
Food groups	*Breakfast*	*Day meal*	*Evening meal*	*Any other*
Energy rich food				
Cereals				
Starchy roots				
Fats and oils				
Sugar and jaggery				
Protein rich food				
Pulses *(dals)*				
Milk				
Fish and meat				
Eggs				
Protective food				
Green leafy vegetables				
Other vegetables				
Fruits				

Does your daily meal contain food items from all the food groups? By missing a food item from one group, you miss one or other nutrient. Your daily meal should contain a good combination of food items derived from all food groups.

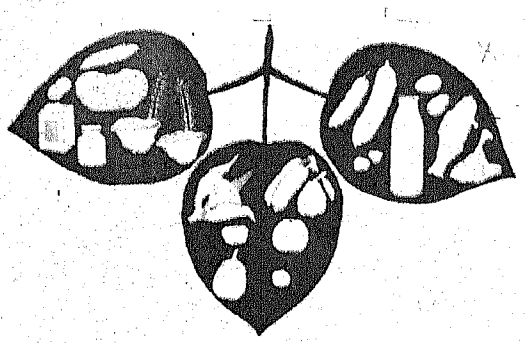
A combination of food items from all food groups is important, so that all types of nutrients are made available to your body. But it is also important that their quantity should be adequate.

What quantity of food is adequate for you?

See the table. Find out the amount of each type of food you need daily according to your age-group.

Foods are eaten in cooked form. Only fruits and some vegetables are eaten raw. In cooked form, what will be the measure of the above given amount? In a cup of 200 gram capacity, the above given amount of food in cooked form will be three to four cups

Food	*Age-group*			
	7-9 years		*10-12 years*	
	Vegetarian (gm)	Non-vegetarian (gm)	Vegetarian (gm)	Non-vegetarian (gm)
Cereals	250	250	320	320
Pulses *(dals)*	70	60	60	60
Green leafy vegetables	75	75	100	100
Other vegetables, roots and tubers	50	50	50	50
Fruits	50	50	50	50
Milk	250	200	250	200
Fats and oils	30	30	35	35
Meat, fish and egg	—	30	—	30
Sugar and jaggery	50	50	50	50

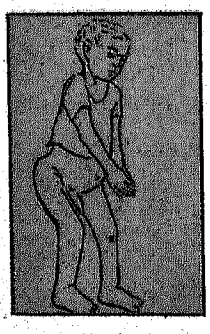
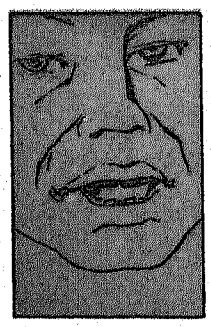


of cereals, three-fourths cup of *dal,* two cups of milk, one-third cup of green leafy vegetables, a cup of seasonal vegetable and a fruit. Your mother cooks food and prepares different dishes at home to serve you at meal time. Help her to prepare a good combination of these foods. She must include in your food everyday grains (cereals), gram green leafy vegetables and milk.

What happens when you do not eat adequate food?

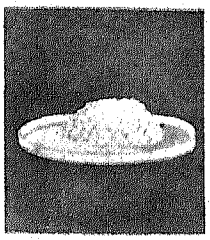
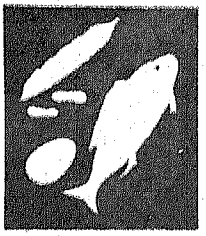
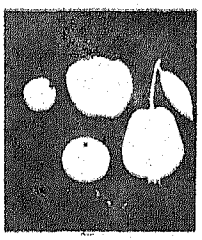
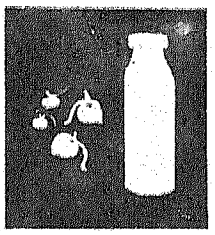
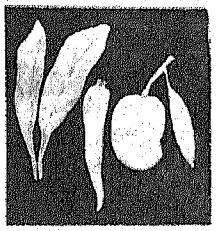
Let us find out

Look at the pictures. Observe what happens when your food lacks any of the nutrients or when it is not adequate.

Not sufficient (Starvation)	Lacks Protein	Lacks Vitamin C	Lacks Vitamin B_2	Lacks Vitamin A
				
All skin and bone Oldman face Wasted muscle Retarded growth Lazy, sleepy, irritable	Swollen legs Swollen face Skin broken Looks like burns Hair discoloured, easily pluckable Dull, irritable	Swollen and bleeding gums Weak Delayed wound healing Tenderness of legs	Sores at the angles of the mouth, lips cracked, tongue fissured	Dryness of the eyes Night blindness White or grey patches on the eye (may lead to blindness)

These deficiency diseases can be prevented by including foods rich in deficient nutrients in your daily meal:

Food rich in energy: rice, wheat or maize, roots and tubers (potatoes), fats and oils	Food rich in protein: milk, pulses, beans, peas and lentils, groundnuts, meat, fish, egg.	Foods rich in Vitamin C: amla, tomato, citrus fruits, lemon, orange sprouted grams, guava, coriander leaves, mint leaves.	Foods rich in Vitamin B_2: sprouted pulses, green leafy vegetables, milk, liver, whole grain grams.	Foods rich in Vitamin A: green leafy vegetables, mango, papaya, carrot, milk, curd, yellow pumpkins, liver.

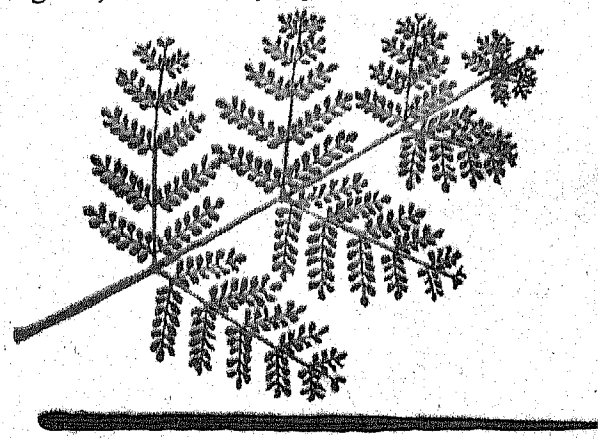






Are all of us active, strong, smart, cheerful? If not, what does that mean? Perhaps the cause is lack of proper food in right amount.

What can we do to get sufficient amount of proper food?

Let us discuss

What is our main food item? It is rice or wheat. Sometimes it is bajra, corn or jowar. Next item of our food is dal and vegetables. But most of us do not get vegetables regularly, and rarely get fruits. Thus most of us lack minerals and vitamins and suffer from deficiency diseases. So we should strive to grow them. By developing kitchen gardens at home we can get seasonal fruits and vegetables such as plantains, guavas, mangoes, papayas, oranges, lemons, tomatoes, brinjals, carrots, radishes, chillies, onions, cabbages, and leafy vegetables. If no spare plot is available for kitchen gardening, we plant drum-stick trees near our houses. Drum-stick (See figure) will supply us vitamins A,B,C,D and minerals such as iron and calcium.



Do you get vegetables and fruits all through the year? List below the locally available vegetables and fruits of different seasons.

Summer		*Winter*	
Vegetables	Fruits	Vegetables	Fruits

Do you get mangoes in winter? Do you get carrots, cauliflowers, oranges, guavas, amlas in summer? Fruits and vegetables are seasonal. They cannot be kept for long like grains and pulses. They have high water content and get quickly spoiled. We get plenty of vegetables and fruits in season at low cost. Can we not preserve them and eat when they are not available?

Which vegetables and fruits are preserved in your locality?

Let us find out

Bring samples of preserved vegetables and fruits available at your home and display them on the table of your classroom. Classify and tabulate.

Food can be preserved by drying, by adding salt, and in sugar syrup. How are they preserved?

Let us find out

Bring raw mangoes, cauliflowers, cabbage, tomatoes or brinjals whichever are available. Wash and cut into pieces. Place on a flat-bottomed wooden tray or any such locally available container. Keep them under the sun till the vegetable and fruits are completely dry. After they are dried keep them in a clean, dry, airtight glass, tin or plastic container or a mud pot.

Dried	*Salty*	*Sweet*

Drying removes moisture and preserves food for a long time. Fish, whole bean pod and mutton can also be preserved by drying.

How are vegetables and fruits preserved by adding salt?

Let us find out

Take some mangoes, cauliflowers, turnips, amlas, lemons, chillies, carrots etc. whichever are available. Wash, cut into pieces. Add salt. Keep in a jar. Spices and oil may also be added. Among the spices added include fennugreek *(methi)*, turmeric *(haldi)*, omum *(ajwain)*, pepper and chillies. Mustard powder is also sometimes added. Mustard oil, rapeseed oil and sesame oil are generally used. These preserved items are known as pickles. Pickles are useful as food items available all round the year. Besides they are useful as additional source of energy and good source of minerals and vitamins.

How is food preserved in sugar syrup?

Let us find out

Take mangoes, amlas or carrots, whichever are available. Take water in a vessel. Add sugar. Boil it for some time to make syrup. Wash the

fruit. Cut into pieces. Add to the syrup. Boil it for some time. Cool. Store in a glass, tin or plastic jar. These preserved foods are known as *morabbas.*

The container should be clean and airtight. Then only the dried and salted vegetables and fruits as well as those preserved in sugar syrup will keep safe for longer time.

Why do vegetables and fruits having high water content get spoiled more readily than dry foods?

Let us find out

Take a large potato. Cut a piece. Put it in an open container. Leave it aside in a dark place. Keep it damp by sprinkling water. Observe everyday. Do you notice some change? Is it smelling different? Has it become soft? Has the colour of the potato changed? Is there any cottony growth? What has brought about the changes? If there is a cottony growth, it surely indicates the growth of an organism. Such cottony growth you will find on foodstuffs exposed to air, in warm and moist weather. They are called moulds. They may be white, black, green, blue or red.

You may have seen a rotten tomato or brinjal. There may not be any cottony growth. But you know that they start giving bad smell. They become delicate and soft. What makes them so? Is it due to growth of some other organisms like mould? Yes. This is how fish, meat, fruits and vegetables when kept for long become spoiled. The spoilage occurs due to growth of some organisms. These organisms grow wherever air, warmth, moisture and food are available.

Where do these organisms come from? Why can we not see them?

Let us discuss

Unless these organisms are present everywhere, they will not be able to spoil food wherever you keep it. They are present almost everywhere, in air, water, soil and dusty objects. They are too small to be seen with our naked eyes. We know their presence through their actions. Can you visualise their size? The diameter of

bacteria is about one-thousandth of a millimetre. About ten thousand million bacteria would be required to weigh one milligram. We can see them only under the microscope. These invisible tiny organisms are commonly known as microbes. Moulds, bacteria, yeasts, protozoans and viruses are different kind of microbes. Viruses are smaller than bacteria. They cannot even be seen with an ordinary microscope.

The microbes such as moulds, yeasts and bacteria are the chief cause of food spoilage.

Are all the microbes harmful?

Let us find out

Mix rice flour and black gram flour. Add enough water. Prepare a dough. Keep the dough in a vessel overnight. Observe next day. Touch it. Is it softer? Do you see some tiny pores? Is it slightly sour? Why has the dough changed? It is due to the action of yeast. This changed dough is used to prepare *idli.* It is useful and palatable to eat. Do you know how curd is prepared from milk? It is due to the action of bacteria on milk. The curd is a useful and palatable food.

Construct a compost pit in your school. Dump leaves, grass, straw, vegetable peelings, skins of fruits, your left over food in the pit. Cover it with a layer of soil. Repeat the process everyday till the pit is full. Wait for six months. Then dig and observe. Everything has changed into manure. The manure is very good for crops. It is the soil bacteria which change the garbage into manure and enrich the soil.

From green mould, penicillin is extracted. Indeed many microbes are quite useful. They are very essential for plants, animals and man. There are some other microbes which cause disease in man. These disease-producing microbes are called germs. Besides germs, worms and other parasites also produce disease in man.

CHAPTER THREE

Our Health and Sanitation

The diseases caused by germs, worms and other parasites are communicable or infectious. They spread from a patient to a healthy person.

How do communicable diseases spread from person to person? They spread chiefly through air, water, food, direct or indirect contact and the bite of insects or other animals. See the figure above.

What precautions should be taken to prevent the spread of communicable diseases?

Let us discuss

You are aware that communicable diseases are caused by germs. The various germs from the infected individuals come out through the exhaled air, sputum, saliva, excreta,

Transmission of Communicable Diseases

Disease causing organisms	*Spread from one person to another through*					
	Air	*Water*	*Food*	*Contact*	*Insects*	*Other animals*
Virus	Common cold Influenza Bronchitis Measles Whooping cough Mumps Chicken pox Small pox	Polio				Rabbies (dog)
Bacteria	Diptheria Pneumonia Meningitis Tuberculosis	Typoid Cholera Bacillary dysentery	Typoid Cholera	Tetanus Leprosy	Plague (flea)	Plague (rat)
Protozoans		Amoebic dysentery			Malaria (mosquito)	
Worms		Round-worm	Round-worm Thread-worm Tapeworm	Scabies Hookworm	Filariatis (mosquito)	Guniea worm (water flea)
Fungi				Ringworm		

other body discharges and wastes. They are carried by droplets in air, by food, by water, by contact, clothes and articles used by the patient, dust, dirt and soil; and by mosquitoes, flies, fleas and other animals. So, to pre-

vent the spread of these germs the following measures are necessary:

1. The patient should be kept in a separate room. To avoid contact, none except those who attend on him or her should be allowed to go there.

2. The occurrence of the disease should be intimated to the local health authority or Primary Health Centre immediately. This will enable them to take immediate steps to check the spread of the disease and to take care of the patient. The germs which might have spread in the living room should be killed. The clothes and beddings can be exposed to direct sunlight to kill the germs. Utensils and clothes used by the patient should be boiled in water. Useless articles such as rags and paper should be burnt. Some chemicals such as phensyle, carbolic acid and formalin kill germs. These chemicals are called disinfectants. The sick room should be sprayed with a disinfectant.

3. Vaccinations develop resistance in the individuals against some infectious disease. So, it is essential that every one should take vaccines in time. When should you take vaccination? See the table on next page.

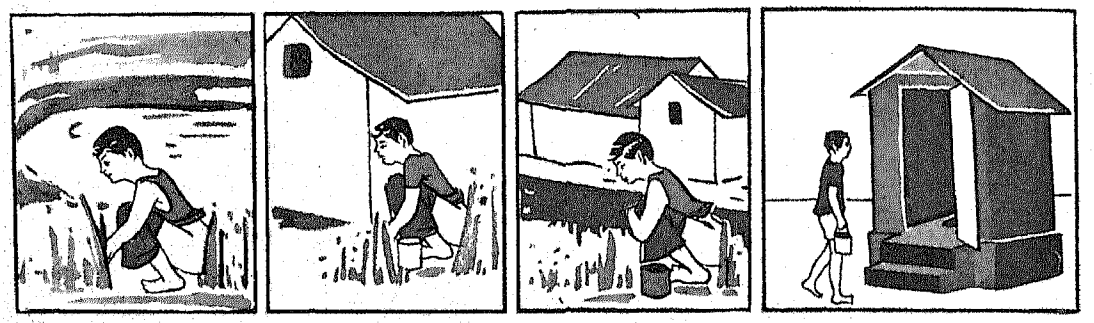
Age	*Vaccine*
ıs soon after birth as possible	Small pox BCG (against tuberculosis)
to 9 months	Triple antigen (DPT) (against diptheria, whooping cough and tetanus) 3 doses at intervals of 4-6 weeks Polio, 3 doses at intervals of 4 to 6 weeks.
0 to 12 months and every 2 years fter that	Typhoid
year	DPT: Ist booster Polio : 4th dose
; years	Small pox (Revaccination) and every 3 years after that
;chool entry (5 years)	DPT : 2nd booster Polio : 5th dose BCG: 1st booster
.eaving Primary	Diptheria and Tetanus : Booster dose

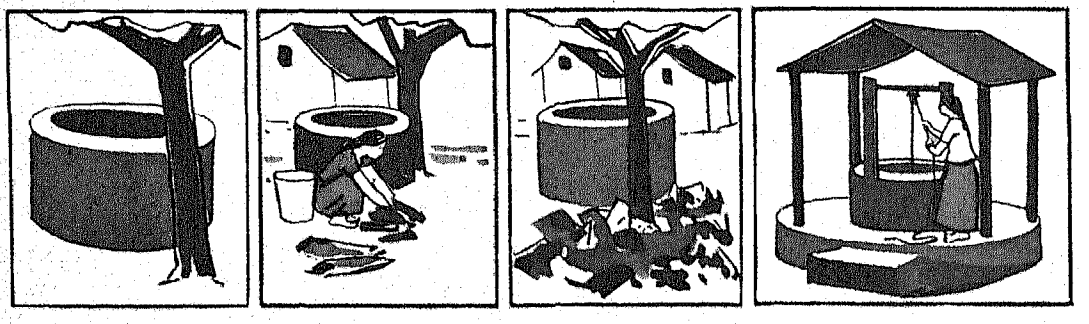
4. You should take care to keep home and surroundings clean and safe from mosquitoes, flies, fleas, lice, rats and mad dogs. Articles of daily use should be kept clean and safe. Water and food should be free from contamination.

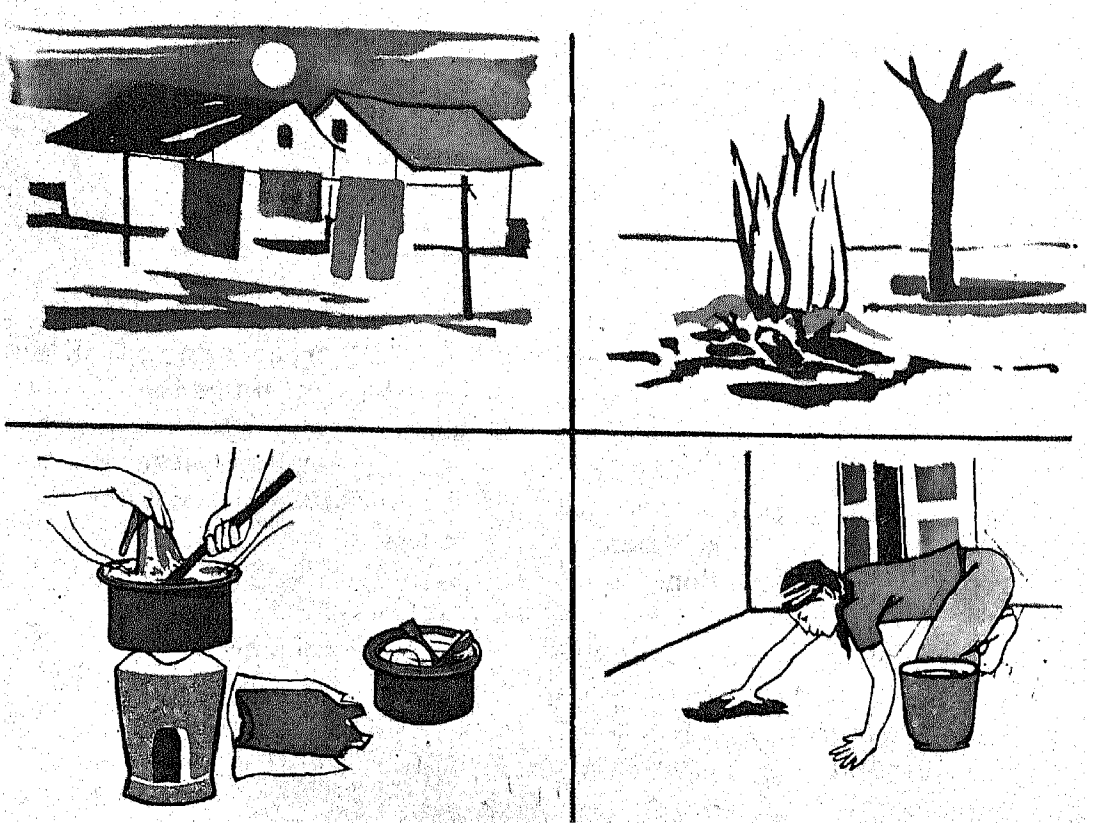
5. Source of water for the community may be a well, a pond or a stream. It should be maintained clean and safe from contamination.

6. Rubbish, garbage and waste from houses should not be thrown anywhere to pollute the surroundings — roads, fields and water source. They should be deposited in compost pits.

People should be forbidden to defecate near the house. One should defecate in a place where neither people, nor animals nor flies can reach.







The supply of safe drinking water and disposal of waste, including human excreta, are two major problems in our villages. Due to these problems, infectious diseases of the stomach and intestine (cholera typhoid, dysentery, and worms) are common in our villagers. Our health status is a balance of interaction between ourselves and our surroundings. It is a big challenge. Let us take initiative and make our village surroundings (homes, schools, roads, fields, wells. ponds, streams) clean, safe and beautiful.

Not only should we take care of our surroundings and keep them safe, but keep ourselves also safe. Accidents occur often. The condition of the patient gets worse without timely and proper help. So, everyone must know what to do in such emergency situations.

What should you do if a small insect or sand particle gets into your eye?

Let us find out

Do not rub the eye. Keep the eye tightly closed. Allow the tears to accumulate. Keeping the eye closed, pull the upper lid down over the lower lid and hold it. The object will be washed away to the inside corner of the eye.

If you do not succeed, then bathe the eye in plenty of water. Then you look up. Let someone revert your lower

eye lid downward with the thumb. If the object is seen, then let him gently lift with the corner of a clean moist piece of cloth or cotton.

If the object is stuck on the surface of the eyeball, do not try to remove it. Place a few drops of til oil or castor oil in the eye. Cover the eye gently with a clean bandage and proceed to the health centre.

What should you do if an insect has entered your ear?

Let us find out

Bring a little warm oil. Put the oil into the ear. The insect will be drowned and killed. Then turn the head to the other side. Let the oil flow out. The insect also will be carried out with the flow. If you do not succeed, then proceed to the health centre.

What should you do if an object has entered someone's nostril?

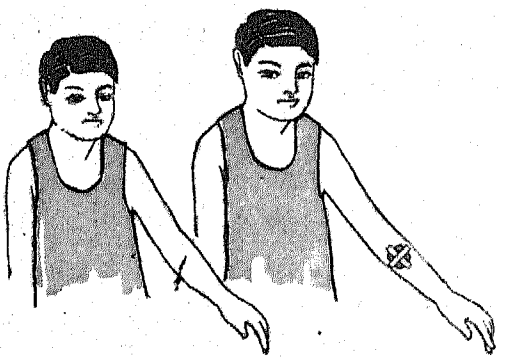
Let us find out

Press upon the patient's other nostril. Allow the patient to take a deep breath through the mouth. Then let the patient close the mouth and breathe out forcefully through the obstructed nostril. Alternately, you can tickle that nostril for a sneeze. The foreign object will be expelled out. If you do not succeed, then take the patient to the health centre.

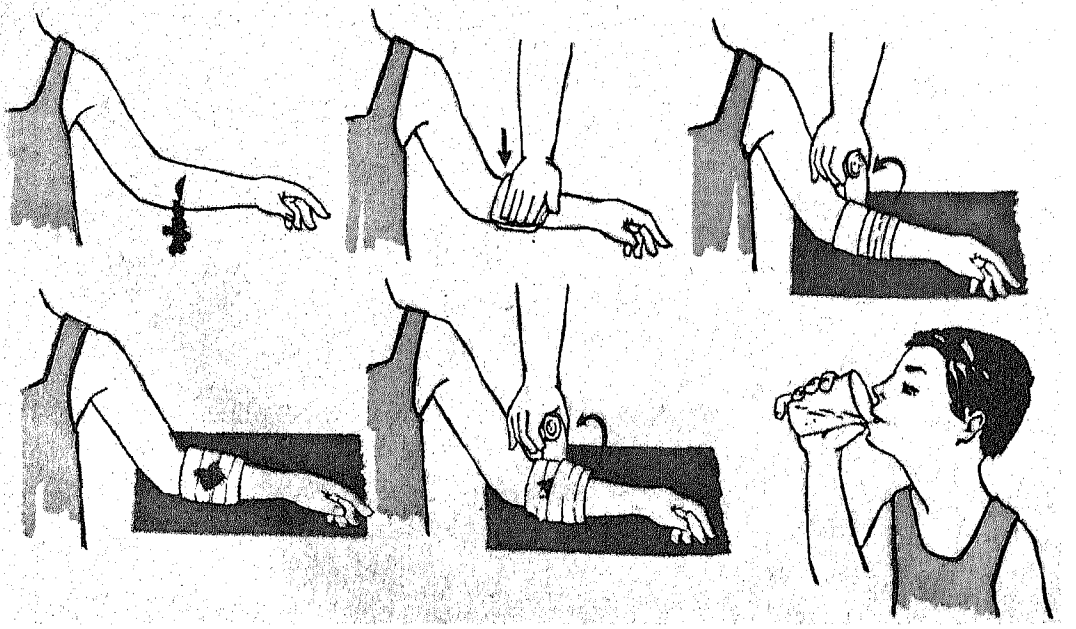
What should you do if someone is wounded?

Let us find out

There is a wound when the skin is cut or torn. If it is a minor one, clean the wound with soap and warm water. Shave off any hair around the wound. Apply tincture iodine. Put a clean piece of cloth over it. Protect it with a bandage or adhesive tape.



If the patient is losing a lot of blood through the wound, then press down hard on the wound with a clean sterilized cloth to stop the blood from coming out. If the bleeding continues,



make a tight bandage over the wound. If the blood comes out through the bandage, wind another bandage more tightly. The patient may be very tired and weak. Make him drink plenty of water and send him to the nearest health centre.

What should you do if someone is stung by an insect?

Let us find out

Get some lime water. Take a piece of clean cloth. Dip it in lime water and apply over the spot several times. Poison of insect sting is neutralized by lime water.

What should you do if the clothes of a person catch fire?

Let us find out

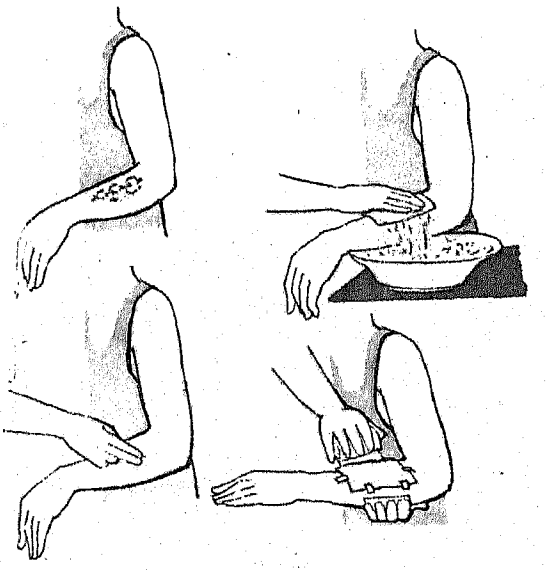
Do not pour water. Bring a heavy blanket. Lay the patient down. Cover him or her with the blanket.

There may be burns. Burns are caused not only by fire. They may be caused due to contact with hot vessel, steam or spilling of very hot water or oil or milk.

In such cases what should you do?

Let us find out

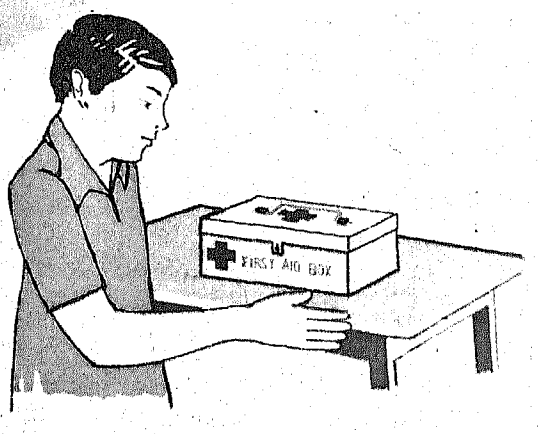
Observe the patient. The burns may



be minor. The patient will be feeling a burning sensation. The spots may become red or there may be blisters. Do not break the blisters. If you can get any antiseptic cream like savlon, burnol or cetavlon, then gently apply over the burns. Put on a very loose dressing.

If a large area of the skin is burnt, lay the patient down on a stretcher. Do not break the blisters. Cover the burnt part with a clean cloth. Give the patient plenty of water to drink. Give stimultants like tea and coffee to drink. Take the patient immediately to the health centre.

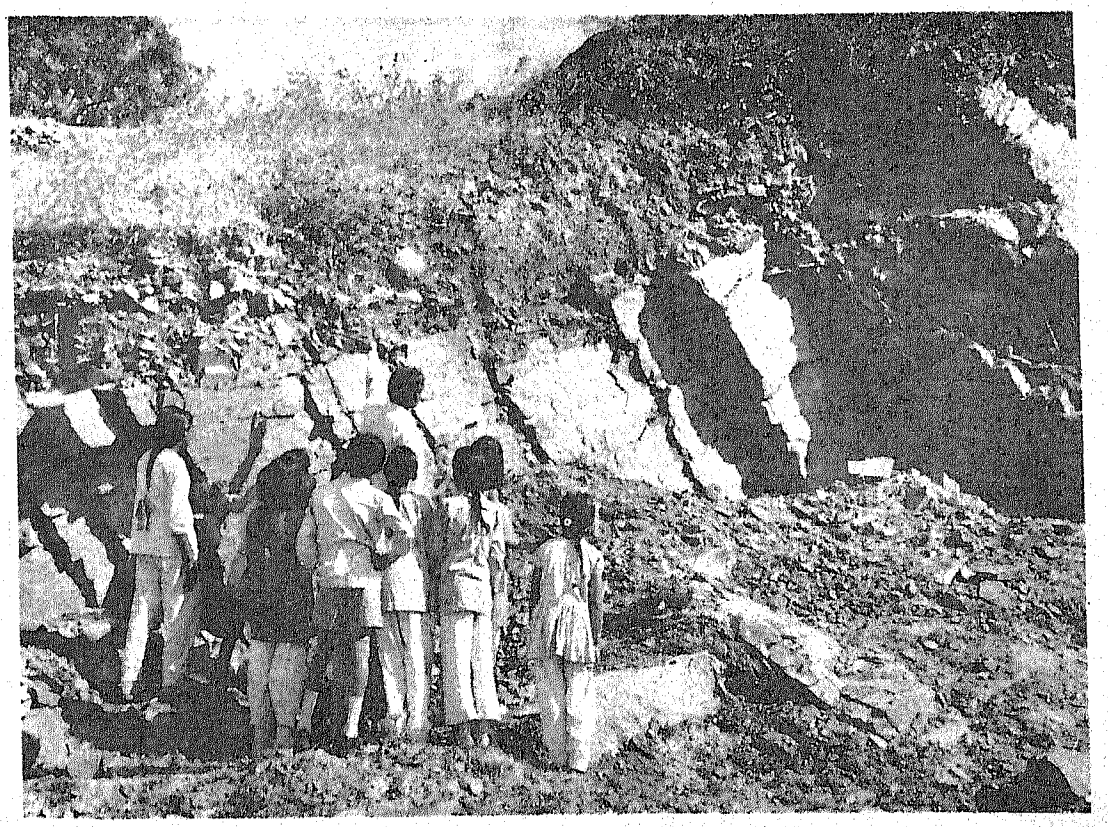
To meet emergency situations, it is essential that you and your classmates should keep in school a small First Aid Box containing the



following articles:
Sterile absorbent cotton pads
Sterile gauze pieces
Roller bandages
One roll of adhesive tape
One pair of scissors and forceps
One small bottle of tincture iodine
One small bottle (50 ml) of tincture benzoin
One small bottle of (50 ml) rectified spirit.
One tube of antiseptic cream like savlon or burnol
One small bottle of antiseptic lotion like dettol
One medicine glass
One toilet soap.

CHAPTER FOUR

Natural Resources of the Earth



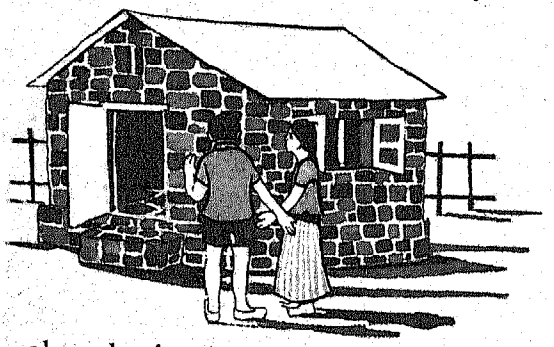
You might have seen rocks on mountains, roadside, construction sites and near river beds. Rocks are natural substances found on the earth. We sometimes find hard rocks after digging the soil.

How do we use rocks? Prepare a list of the articles in your home which are made of rocks. Also prepare a list where rocks are used as construction materials. From where do we get these rocks?

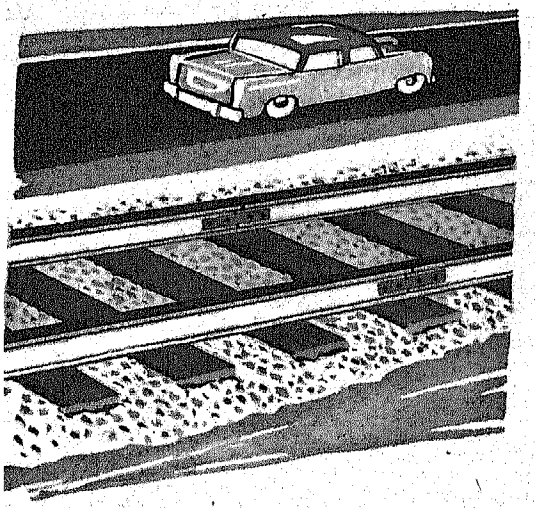
What is done to these rocks, so that they become suitable for a specific use?

Let us discuss

Rocks are taken out from quarries or collected from river beds. They are



also obtained from the rocky mountains. Many of the rocks after cutting (then called stones) are used as a construction material in building walls, roofs and floors of houses. Stones are also used for the construction of roads and railway tracks.



Almost all metals are obtained from rocks. The rocks rich in various metals are called ores. Metals are extracted from these ores in factories.

What do the rocks contain?

Let us find out

You may have noticed some peculiar stones, rocks, soil around your village. Examine a piece of rock. What do you observe? Powder a piece of rock by hammering it. Observe the powder carefully. How many types of grains do you find in the powder? Are these different in colour?

What does the colour difference indicate?

Let us discuss

Minerals are natural substances found on the earth. The colour difference in particles is due to different minerals present in the rock. Granite is one of the rocks. It has three different types of particles: glass like particles (quartz), white or pink particles (felspar) and white shining layer-type particles called mica.

How do we use these minerals?

Let us find out

You may have many types of utensils in your home. Make a list of these

utensils. Classify them into groups such as earthenware, glass like, iron or aluminium like and plastic like.

This table shows how utensils made of different minerals are used in your home.

Types of Utensils

Earthenware	*Glass like*	*Aluminium like*	*Rubber like*
1.	1.	1.	1.
2.	2.	2.	2.
—.	—	—	—
—	—	—	—

What are some other uses of minerals?

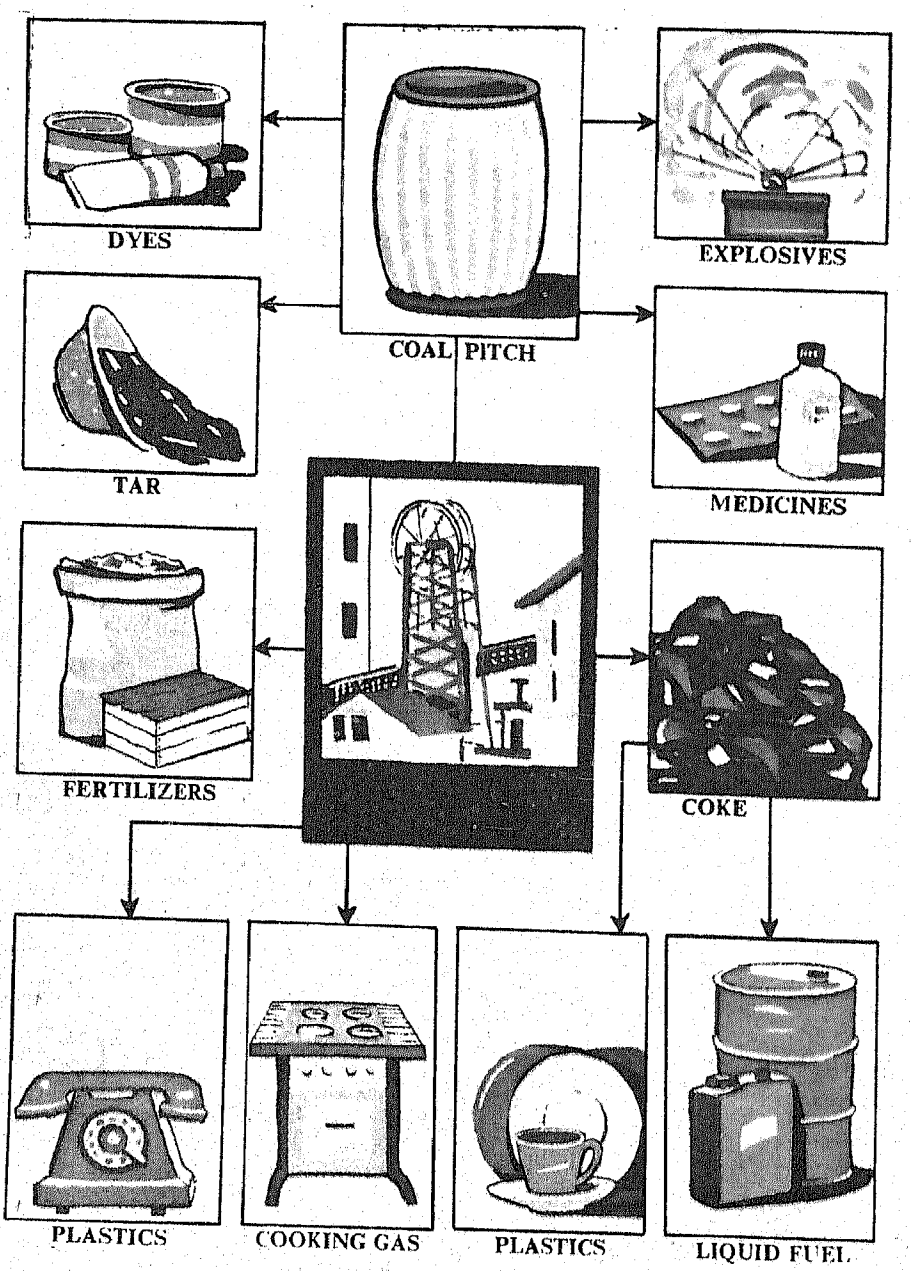
Let us discuss

Minerals have many uses in our daily life. We use them in a variety of ways either directly or after purification. Salt is taken out of mines and used as such. Salt is also obtained by purification of lake and sea water and then used. Electrical wires, parts of machines, ploughs, shovels etc. are things made of metals. Similarly you can find many items made of ceramics, plastic, baked earth etc. The drugs, dyes, paints, synthetic fibres (such as terylene, nylon) and many chemicals also are made out of minerals.

How do we get the metals from rocks?

Let us discuss

Metals are extracted from the soil, sand or rocks. It is not easy and profitable to extract metals from the soil. Some metals like gold are found in pure form in sand and rocks. Unlike gold, most of the metals are found in a combined form. The combined form of metal is called an ore. Ore is a mineral from which metal can be extracted easily and with profit.

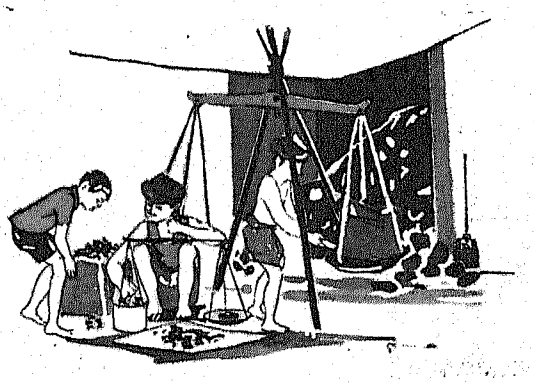

DYES
COAL PITCH
EXPLOSIVES
TAR
MEDICINES
FERTILIZERS
COKE
PLASTICS
COOKING GAS
PLASTICS
LIQUID FUEL

Coal is used as a fuel.

How many types of coal have you seen e.g. charcoal, stone-like coal etc.? What is the difference between them?

Let us discuss

Take a piece each of different types of coal and try to assess their properties i.e. hardness, shape and the ease with which they burn.



Charcoal is obtained from burning of wood. Stone-like coal is taken out from mines. It is formed inside the earth by the decay of plants in the absence of air, after millions of years. Most of the coal in India is found in Bihar, West Bengal, Madhya Pradesh and Orissa.

What are some of the products of coal? Make a list of items that you know. See the diagram. Like the products of coal, petroleum products have many uses in our life today.

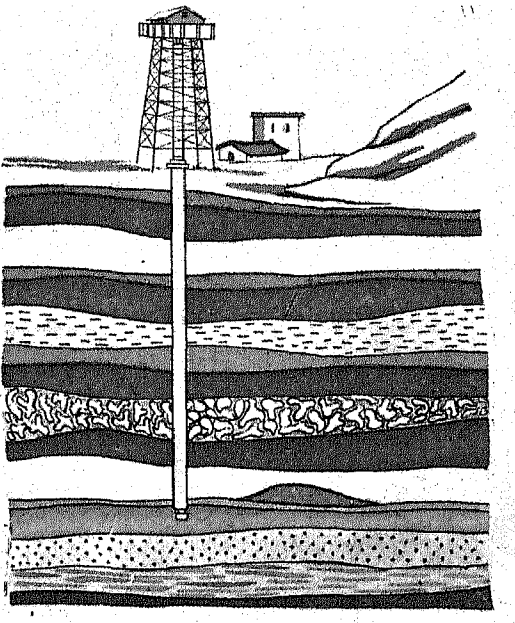
What is petroleum? Where from do we get it?

Let us find out

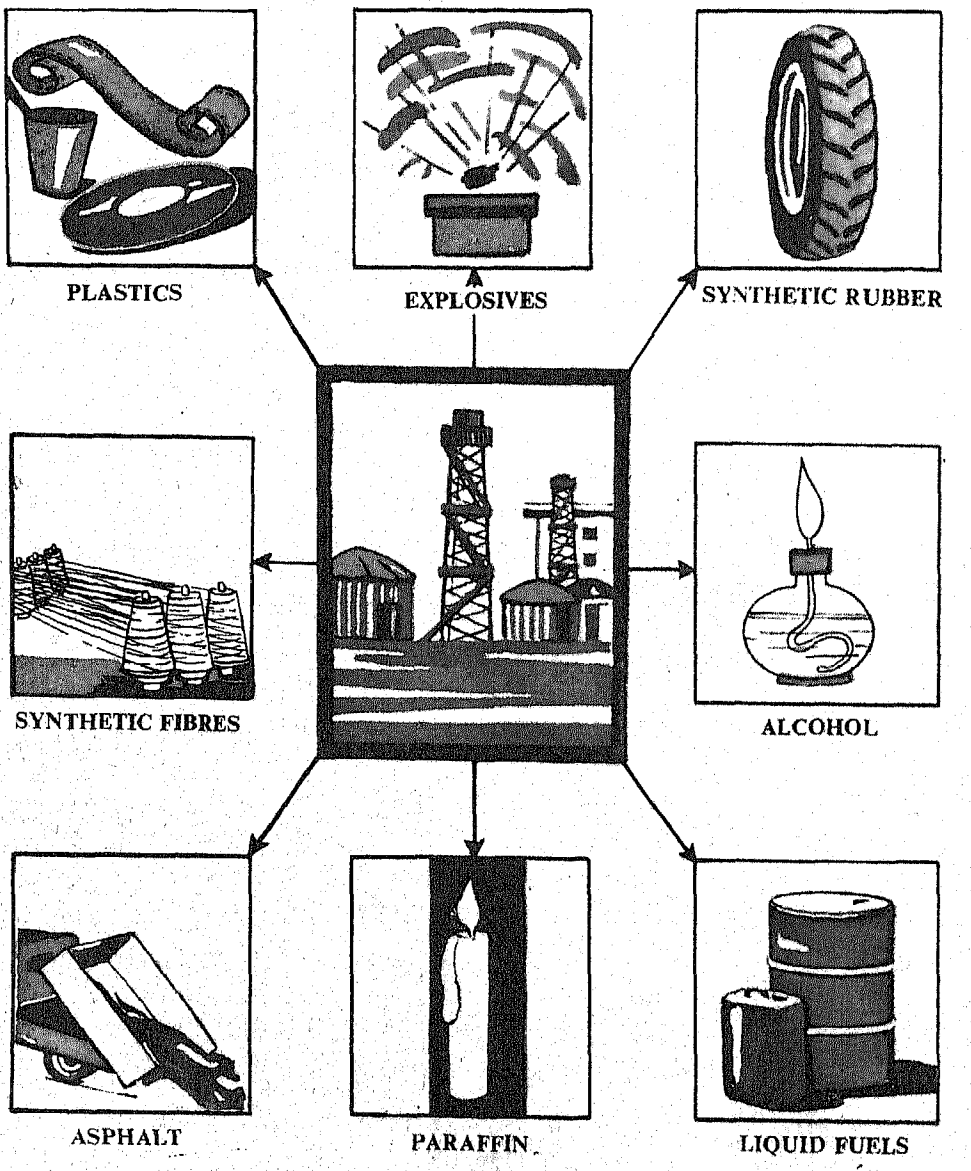
You might have seen petrol. What is its colour and smell? Where do we use this liquid?

Petroleum is formed inside the earth by the decay of plant and animal remains. From these it is pumped out. It is purified and petrol is obtained.

It is a yellowish liquid having a characteristic smell. Scooters, cars, buses etc. use petrol as a fuel.



The Arab countries, Iran, Russia and America are the chief producers of petroleum and its products. Our country is also trying to produce


PLASTICS
EXPLOSIVES
SYNTHETIC RUBBER
SYNTHETIC FIBRES
ALCOHOL
ASPHALT
PARAFFIN
LIQUID FUELS

enough of petroleum and its products to meet the demands.

The industrial progress of a country depends mainly on coal and petrol it has at its command. It is therefore sometimes called 'Liquid Gold'.

Are minerals useful in agriculture?

Let us find out

You may have seen farmers purchasing chemical fertilizers, insecticides etc. in the market. What do they do with these substances?

Have you ever seen a farmer spraying some liquids on fruit trees in his orchard? Can you name a few of them? Prepare a list of fertilizers and insecticides in a tabular form.

Chemical fertilizers are added to the soil to provide the minerals taken away by earlier crops. Some of the well-known chemical fertilizers are Ammonium Sulphate, Calcium Super Phosphate, Murate of Potash.

Insecticides are chemical substances used to kill insects which harm the crops. Some of the well-known insecticides are Melathion, Gammaxene, Polythion.

Do food-stuffs also contain minerals? Which food-stuffs contain minerals? What sort of minerals are found in them?

How are these minerals helpful in our growth and existence?

Let us discuss

Almost all food-stuffs contain one or

Chemical Substances Used in Agriculture

Fertilizers	*Insecticides*
1.	1.
2.	2.
—	—
—	—

the other type of minerals. Some of the important minerals found in them are iron, calcium, potassium, phosphorus and iodine. You have already studied about some of these.

Does soil contain useful minerals, salts without which plants cannot grow?

Why do we add fertilizers or manure before growing every new crop?

Let us discuss

Plants are grown in soil. They take up the minerals required for their growth from the soil. Thus, the soil loses these minerals. Therefore it is essential to make soil fertile before growing the next crop.

Plants need minerals for their growth.

Why do farmers add dung manure to their fields?

Let us discuss

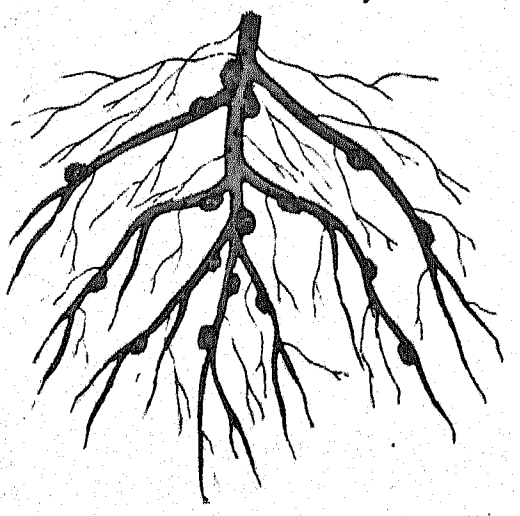
You may have seen farmers adding dung manure to their fields. They add it in addition to the chemical fertilizers to their field. Why is it so?

Dung manure adds many minerals to the soil which are either absent in the particular soil or have been used up by the plants. It makes the soil fertile by adding certain fine decayed material (humus) to it which the chemical fertilizers do not provide.

Is the soil made fertile by growing pulses or gram between two successive crops?

Let us find out

You may have seen farmers growing crops like beans, peas, grams and *arhar* etc. in the fields. They usually grow such crops between two successive crops. Why do they grow such crops in between other crops? Take out one of the plants of peas, gram or beans and observe carefully its roots.



What do you observe? Beans, peas, grams and *arhar* are called leguminous plants. Leguminous plants have small outgrowth (nodules) on their roots.

A type of bacteria is present in these nodules which converts atmospheric nitrogen into nitrogen compounds, which plants can easily take. Growing of leguminous crops make the soil fertile.

Why do we plough soil before sowing seeds?

Let us find out

You may have seen farmers ploughing their fields before sowing seeds. They plough deep so that the lower portion of the soil comes to the top and the top portion of the soil goes down. What difference does ploughing make to the crops?

The upper portion of the soil becomes poor in many minerals by growing crops. The lower portion of the soil is rich in these minerals. The upper portion of the soil also contains some plant remains, which gets decayed into manure by ploughing. It is necessary to plough the soil after every crop, so that the soil is fit for growing a new crop.

CHAPTER FIVE

Air and Water

As you know, air is present everywhere. Even an 'empty' tumbler is otherwise full of air. Air has many interesting properties. Let us explore one of them.

Bring a tumbler close to your mouth. Suck air out of the tumbler. Remove your hands from the tumbler.

Why does the tumbler not fall down?

Let us find out

Take a glass bottle. Nearly fill it with water. Put a clear drinking straw in it as shown. Observe if possible the level of water inside the straw. Is it the same as that of the water outside,

in the glass bottle?

Try to suck water through the straw. Does the water rise in the straw? How does the water reach your mouth? Can you explain why water rises in the straw?

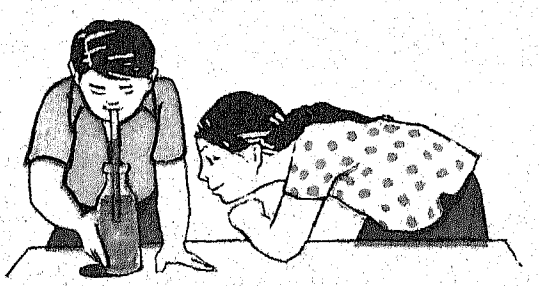
As you suck air out of the straw, water rises in the straw. As you leave the straw end open, the water falls down.

Suck water in the straw. Close the upper end with your finger. Now release pressure gently. You will see that water drops out slowly.

What has air to do with this rise and fall of water in the straw?

Let us discuss

Air is present everywhere. It constantly presses down on the surface of water. It presses both inside and outside the straw. Hence the level of water, outside and inside, is the same. When the air is sucked out through the straw, there is very little pressure inside the straw. Hence water from the bottle is pushed up in the straw.



When the straw end is left open, air rushes into the straw. It pushes back the water in the straw to the original level.

Now think what happened when you sucked air out of the tumbler. The pressure of air inside the tumbler was less than the pressure of the air outside the tumbler. So the tumbler did not fall when you removed your hands from it.

Air has many uses. It is used to fill balloons. Name any other three uses with which you are familiar. Many uses of air are based on its pressure.

What are some of the uses based on the pressure of air?

Let us observe and discuss

Study the picture on page 46. Name the things that are being inflated with air. What happens when air is blown into a balloon? Why does the balloon bulge out?

Air exerts pressure; and we make use of this fact in each of these cases.

Many a time, air pressure is used to move liquids. You have studied how air pressure works in the case of drinking straw. You might have also seen a kerosene pump in use.

An eye dropper or a fountain pen filler also works on the principle of air pressure.

How do they work ?

Let us find out

Take an eye dropper, syringe or fountain pen filler. Hold it as shown with one end dipping in a coloured liquid. Push down the piston or press

the filler. Where do the air bubbles come from in the liquid? Pull up the piston or release the filler. What do you observe? Why does this happen?

A common lift pump works on the same principle as a *pichkari* or a syringe.

How does a lift pump work?

Let us find out

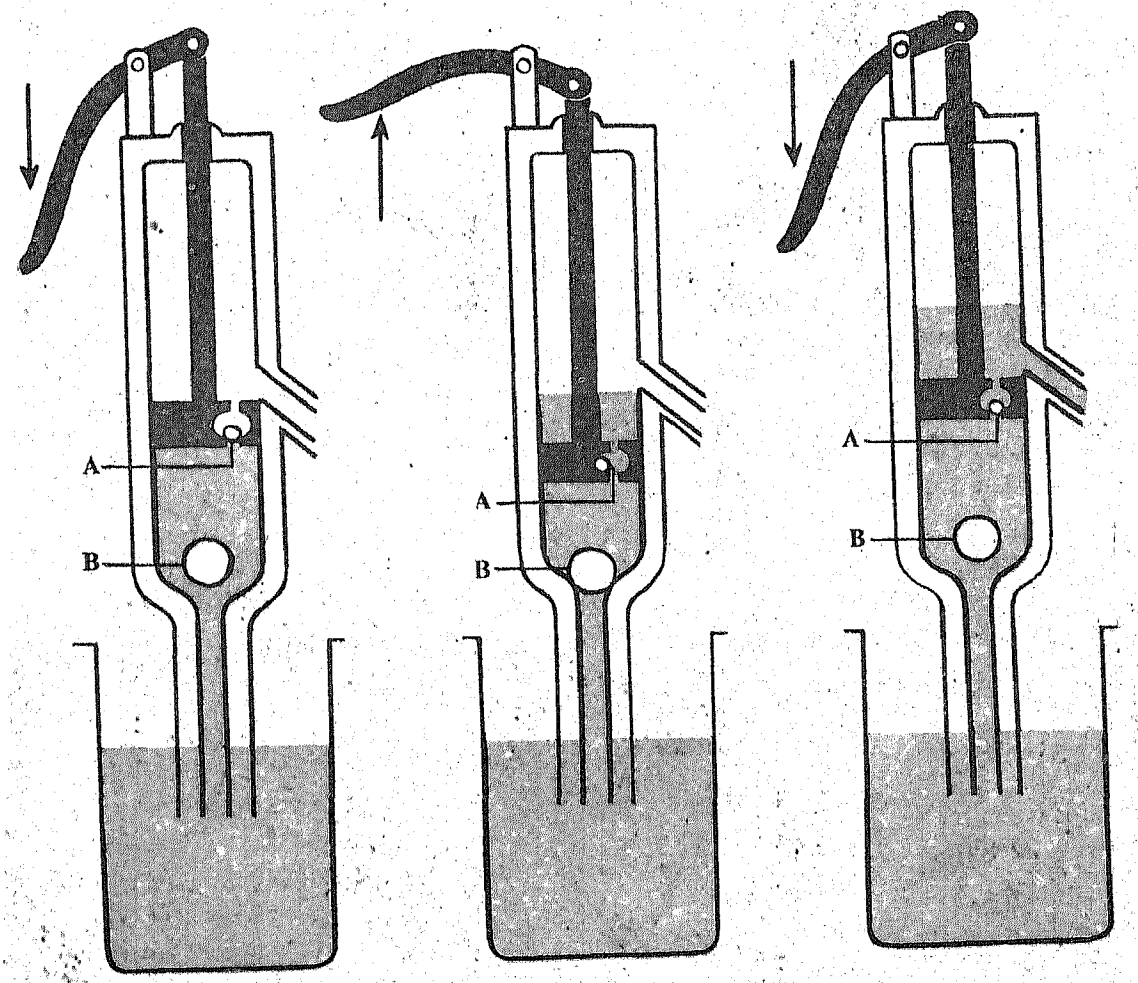
You must have seen a hand pump. Relate your observations to the diagram, given here. If possible go to a hand pump. Open the pump and see the valves. Work it to fill a bucket of water. Find out when the water gushes out of the pump, in the downward stroke or the upward one? How will you explain?

Study the figure showing the working of a hand pump. Locate the two valves A and B. What happens to the valves when the piston moves up? What happens to the valves when piston moves down? What makes the valves open and close in the two cases?

We learnt that air pressure can be used to move liquids such as water, petrol, kerosene. In all these cases, air is removed first. Normal air pressure then forces the liquid up.

Air has many uses which are not related with the property of air pressure. Name one or two such uses. You know that air exists as gas. But it is not just one gas. It is a mixture of gases. Air is needed for living things because it contains oxygen. Besides oxygen, there is nitrogen, carbon dioxide, and water vapour in the air.

Of all the gases in the air, oxygen is by far the most important. Why is it so?



Let us discuss

How does your mother 'brighten up' fire in *chulha* or *angithi* at home? Study the picture. An ironsmith is using a blower to make his charcoal fire burn more brightly. What thing from the blower is being aimed at the fire?

Why does fanning or blowing air cause a fire to burn more intensely?

Does burning require something that is in the air?

Let us find out

Set two small candles of equal size erect on the table. Light the candles. Place a large, wide-mouthed bottle upside down over one candle. Place a smaller bottle over the other candle. Watch the candles' flame.

How long do they continue to burn? In which case does the flame go out first?

Why did the candle covered by the smaller bottle burn for a shorter time?

The larger bottle made a larger amount of air available to the candle flame for burning. This made the candle to burn for a longer time. It shows that air or a part of it is used in burning.

The part of air used up in burning is called oxygen. We burn fuels like firewood or charcoal. These fuels need oxygen (from air) for burning. On burning, we get heat energy.

Oxygen is also the part of air used up in respiration. All men and animals take in air by breathing.

The blood in the lungs takes oxygen from the air breathed in. The blood carries this oxygen to all parts of the body. In the presence of this oxygen food is to some extent used up to release energy for work and play; as well as certain wastes are produced. It is somewhat like burning of coal in a locomotive engine to release energy which is used for running the trains. The ashes produced are like the waste products. In Class IV, you studied about two such wastes, namely, water vapour and carbon dioxide.

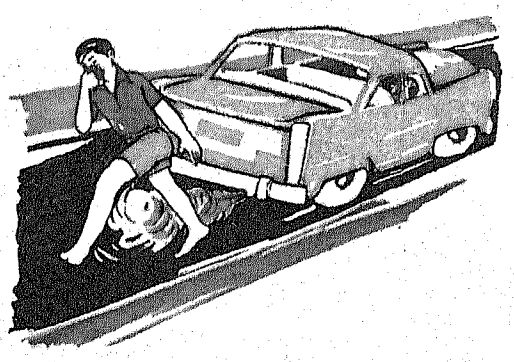
Have you been to a place where there was a lot of smoke? How do you feel near a fire-place where damp firewood is burning? You must be able to recollect the experience of being in a smoky place. What happened to your eyes? How different is the experience of walking in fresh morning breeze?

Air is polluted by smoke. Such air is not suitable for breathing. Tears trickle down our eyes and they also become red when we stay in a smoky place.

What are some of the other things, besides smoke, which pollute air?

Let us discuss

Study this picture. Why is the boy running to get away from behind the



car? In cities, the smoke given out by automobiles pollutes the air. Why is the boy putting a handkerchief to his nose? He wants to avoid the bad smell present in the smoke of the car.

Smoke from steel plants, thermal power stations and factories pollutes the atmosphere in a big way. They are, therefore, located away from the cities, so that air pollution does not harm the people very much.

Polluted air is harmful to our life. We should always try to be in fresh air. Open windows and ventilators help in keeping the air of your room fresh. Trees and green plants help to keep air fresh by taking up carbon dioxide and releasing oxygen. Many cities keep green belts to get fresh air.

Water is a good solvent. It dissolves many things as it flows over land or seeps through layers of soil. Natural water would, therefore, contain many dissolved substances. Besides, it may contain insoluble substances and germs.

How do we remove insoluble impurities from water?

Let us find out

Fill a tumbler with muddy water from a river or a pond. Keep it undisturbed for some time. What do you find at the bottom of the tumbler?

The larger and heavier insoluble particles settle first. These may be small pieces of stone, particles of sand, or animal and plant remains. The lighter particles remain suspended or even float.

Floating things except fine particles can be removed with the help of a spoon. For helping the fine suspended particles to settle, mix a little alum to the muddy water. What differences do you notice in water?

The insoluble impurities settle down more quickly with alum. The water becomes clearer than what it was earlier. This process of cleaning water is called *sedimentation.*

How can we remove the clear water from impurities that have settled down?

Let us try

Hold the tumbler. Gently tilt the tumbler containing muddy water.

Pour the upper clear liquid into a *katori.* This process is known as *decantation.*

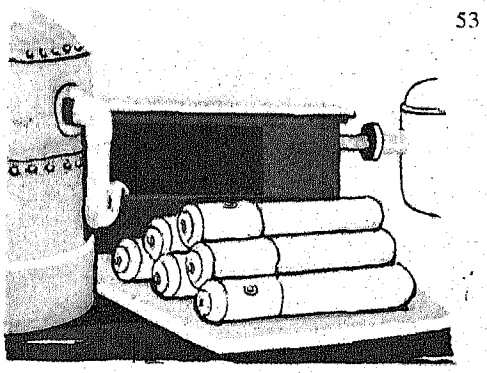
All insoluble impurities can be removed from water by *filtration.*

How do we filter muddy water to get clear water?

Let us try

Take a funnel, like the one used for

pouring out kerosene oil into a bottle. Arrange a cotton pad in the funnel as shown in the figure. Pour the muddy water into the funnel.



What do you see on the cotton pad? What do you notice about the water collecting in the tumbler below the funnel?

A cloth piece may also be used for filtering solutions. Can you cite an occasion wherein you saw this?

The clear water obtained by filtration may still contain germs. These are not visible. You can see them only under a microscope. These germs may cause many diseases. The simple way to remove germs is to boil water for a sufficient length of time. Boiling will kill the germs and make the water safe for drinking.

Some of the germs are, of course, removed by sedimentation and filtration.

Are there other methods to kill germs?

Let us discuss

Have you ever seen a substance being added to wells, thus making well water red? You might have noticed such water in dispensaries as well. This substance is potassium permanganate. Its crystals are dark violet or almost black. Addition of this chemical to water kills germs.

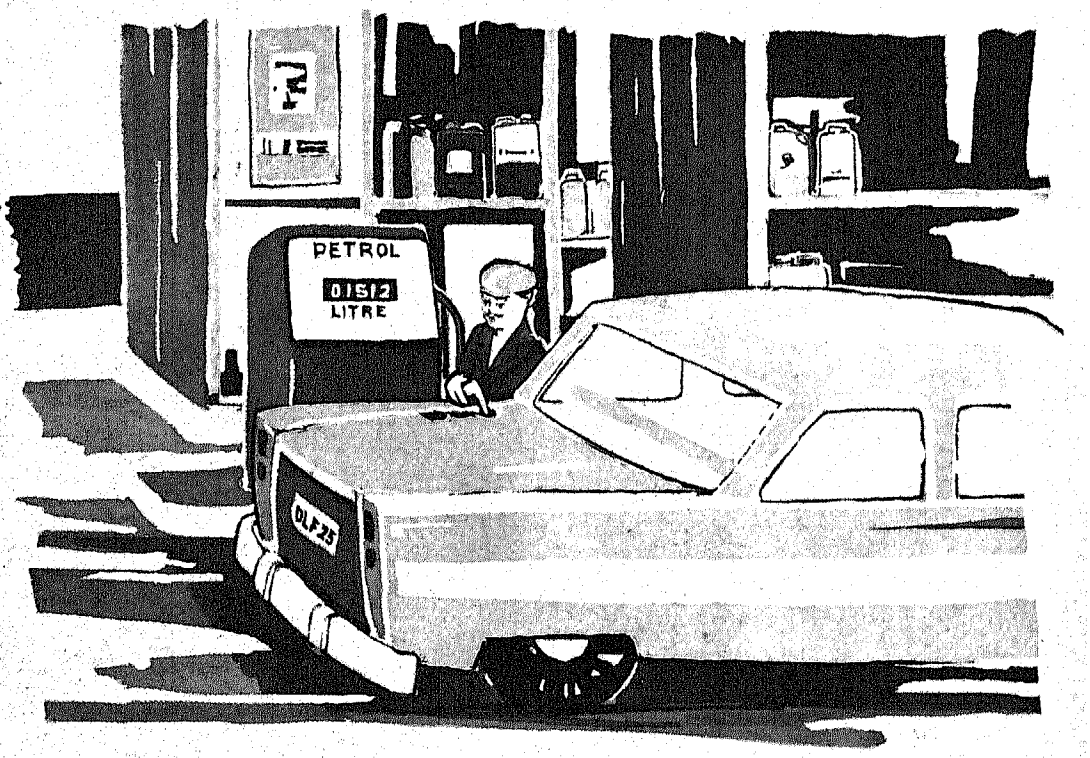
Addition of chlorine is another way of killing germs. Chlorine is a gas. Water as supplied in many cities is treated by this method.

Killing germs by adding chemicals to water is a convenient method. But it often gives a bad taste to the water. Rain water is usually clean especially if it is collected after it has rained for some time. There are very little impurities dissolved or suspended in it. Even such very pure water may not be good for drinking. In fact, some of the dissolved substances give a taste to water and are also useful for the growth of our body.

Germ-free drinking water should be stored with care. The pot should be clean and kept covered with a clean cloth or a clean lid. Vessels for drinking water should also be kept clean and free from germs.

CHAPTER SIX

Volume, Weight and Density



When you go to the market, you can buy a kilogram of potatoes or onions or tomatoes. You can also buy butter or fruit by weight. But can you buy one kilogram of milk or two kilograms of kerosene oil? No. You buy them by litres.

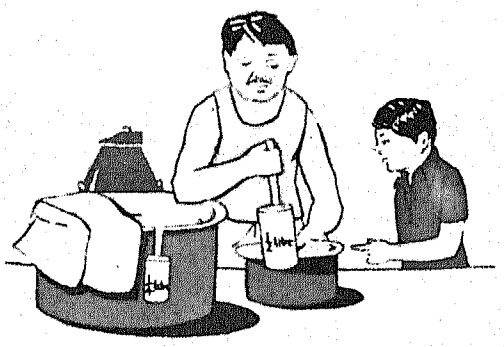
When a driver of a car goes to a petrol pump, he orders 5 litres of petrol. Does he buy petrol by weight? No, he buys petrol-by volume.

What is volume?

Let us discuss

Take a half-litre glass bottle. Or, you may take a measuring can from the

milkman. The can will be marked half litre or one quarter litre.



a fixed volume.

Perform the following activity: Take three different vessels from your home. You may take a bottle, a glass tumbler and a cooking pan. Find out approximately the volume of each of them with the help of a half-litre bottle or a measuring can from the milkman. Then complete the table below.

S.No.	*Vessel*	*Volume (litres)*
1.	Bottle	
2.	Glass tumbler	
3.	Cooking pan	

Fill the half-litre can with water. How much water is there in the can? The amount of water is half litre. We also say that the volume of water in the can is half litre.

Fill the can with kerosene or some other oil. Now the volume of the oil is half litre. The volume of the can is fixed. It is half litre. It does not depend upon what liquid is in the can.

Similarly, take some tumbler or bottle or cooking pan. Each of them have

Do solids also have volume?

Let us find out

Take a tumbler filled with water and put the tumbler in a bigger vessel like a cooking vessel or a pan.

Now put a solid like a potato into the tumbler. What happens? Some water flows out from the tumbler into the pan. Collect this water and find out its volume approximately. Suppose it is 0.1 litre. Then the volume of the potato is equal to the volume of water collected. So, the volume of the potato is 0.1 litre.

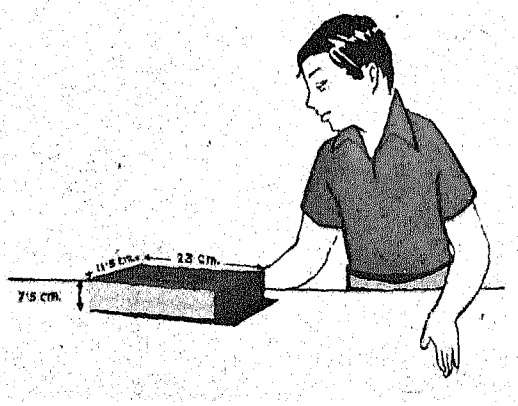
In this way, you can find out the volume of different things like a solid ball, a brick, a stone etc. But the solid ball must sink in water. Otherwise, you cannot find its volume by this method.

Is there another method of finding the volume of a solid?

Let us discuss

In your mathematics class, you have studied that you can find out the volume of a solid by measurement.

Take a brick. Measure its length, breadth and height. Calculate its volume by multiplying the three. If you measure in centimetres, then the volume is in cubic centimetres. This is also written as c.c.



You should also note that

	1000 c.c.	= 1 litre
Then	500 c.c.	= half litre
and	250 c.c.	= quarter litre

1 c.c. is equal to one thousandth part of a litre. This is called millilitre and is written as ml.

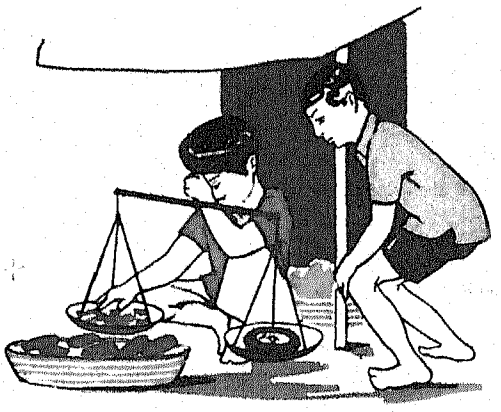
So 1 c.c. = 1 ml.

Now you know about volume. Can you answer these questions?

Which has larger volume: One kilogram of potatoes or half kilogram of potatoes?

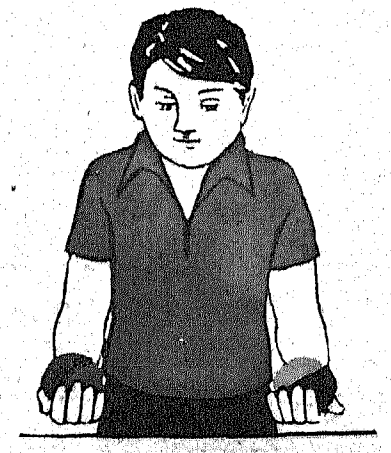
Is the volume of one kilogram of potatoes larger than that of one

kilogram weight (standard 1 kg weight) ?



Is the volume of one kilogram of cotton larger than the volume of one kilogram of potatoes?

Hold a hockey or cricket ball in your hand. Now hold a rubber ball of the same size in the other hand. Which ball appears to be heavier?



You have probably carried a bag containing vegetables from the market to your home. Do you know when the bag will be heavier: when it is full of potatoes or when it is full of some green vegetables like *palak* (spinach) or *baingan* (brinjal)?

What can we conclude from the above observations?

Let us discuss

We see an interesting fact from the above examples. We find that although volumes of the two balls are the same, the hockey ball is heavier than the rubber ball. Again, the bag when it contains potatoes is heavier than when it contains brinjals.

We can also say that hockey ball is more dense than the rubber ball, and potatoes are more dense than brinjals.

What happens when we take liquids instead of solids?

Do equal volumes of different liquids have different weights?

Let us find out

Take two similar glasses or bottles. Fill one glass with water. Fill the other glass with another liquid like kerosene or mustard oil.

Weigh them separately. Or, you may put one glass in one pan and the other

glass in the other pan of a common balance *(tarazu)*. Do the two glasses balance? Which glass is heavier? You will find that the glass filled with water is heavier than the glass filled with kerosene oil.

This shows that equal volumes of water and kerosene oil have different weights. We see that water is more dense than kerosene oil. We can also say that the density of kerosene oil is less than the density of water.

Can the weight of a solid be compared with the weight of an equal volume of liquid?

Let us discuss

Take a vessel filled with water. Drop a large potato in the vessel and collect the water that overflows from the vessel.

The volumes of the potato and the water collected are equal.

Find the weights of the potato and of the water collected. Record these weights as given below:

Weight of potato = gm
Weight of water collected = gm

Which weight will be larger? You will find that weight of the potato is larger than that of equal volume of water.

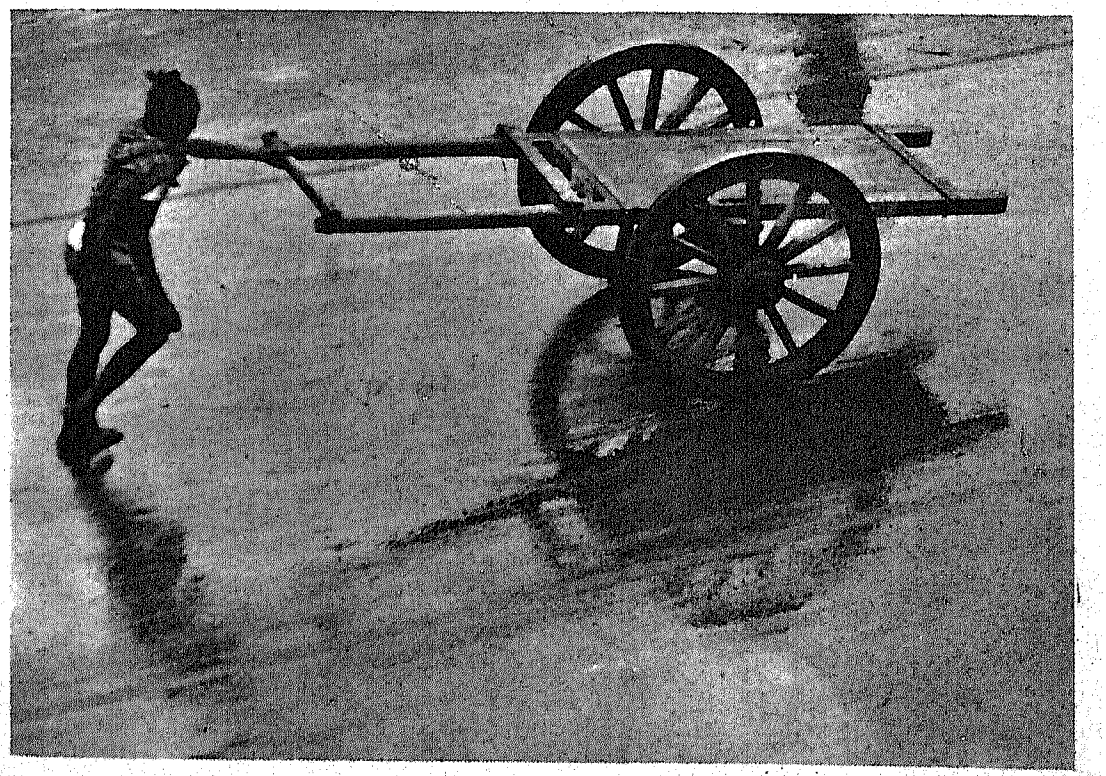
So, the density of the potato is larger than the density of water.

In the same way, you can find out weights of different solids and liquids. You will find that weights of different materials having the same volume are different.

This means that different materials have different densities.

CHAPTER SEVEN

Machines to Do Work



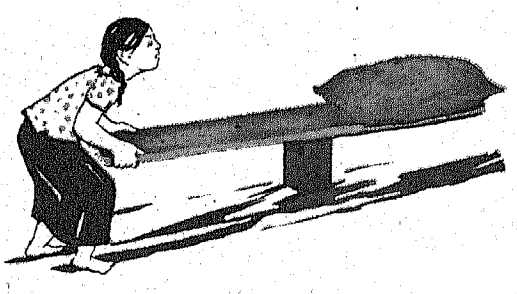
You can easily lift your school bag containing books. But can you lift a heavy load like a sack full of wheat, rice or sand? Probably you cannot lift it with your hands only.

Then how can you lift it?

Let us find out

Take a flat wooden plank and put it on a block of wood or a smooth stone. Then with the help of your friends put the sack on the plank near the block as shown in the diagram. Push down

the other end of the plank. You can easily lift the sack this way?



How then are you able to do so?

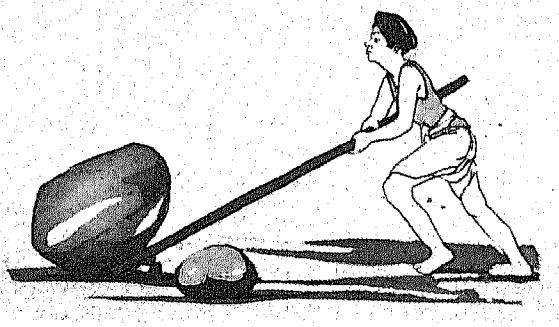
Are you applying greater muscular force while pushing the plank down? No, But the block and the plank help you to do what you could not with your muscles alone.

The combination of the block and the plank used in this way is called a lever.

What are the other examples of levers?

Let us discuss

You may have seen labourers using iron rods to remove very big stones.



Look at the figure. Tell how the labourer is lifting the heavy stone with the rod.

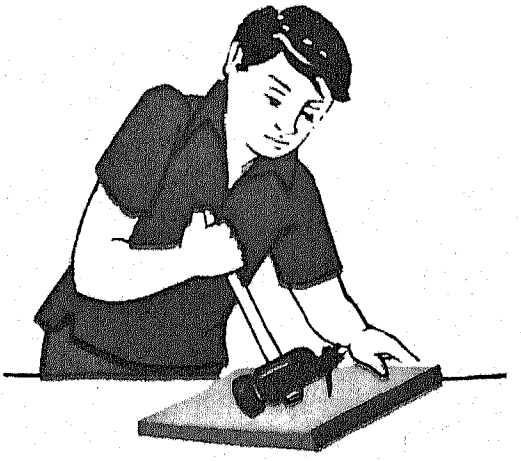
In this case, what are the two things that combine to form a lever?

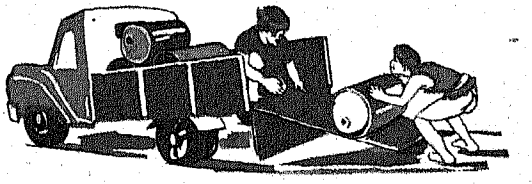
When the lid of a tin does not open with your hands, how will you open it? You can do so by putting a knife or a spoon between the lid and the edge of the tin and by pushing the knife

down. Here you are using the knife or the spoon as a lever. Similarly when you pull out a nail with the help of a hammer, the hammer is used as a lever.

Other examples of levers are see-saw, scissors, pliers, nut-crackers etc.

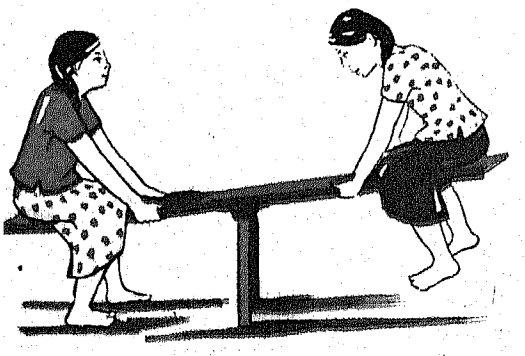
Have you seen barrels of oil or coal tar being loaded on or unloaded from a truck? How is it done?





Let us discuss

A flat board is placed with one end on the truck and the other on the ground in the form of an inclined plane. The barrels are then rolled up the inclined plane into the truck. The inclined plane helps to put the barrels into the truck. It is more easy to roll the barrels up rather thar lift them from the ground.



At a construction site, you may see labourers carrying loads on wooden boards placed in inclined position. These boards help the labourers to take bricks or cement from the

ground to the top of the buildings.

Can these inclined boards or levers work themselves?

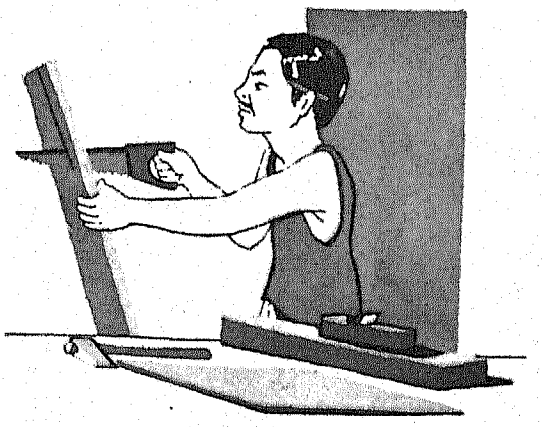
Let us discuss

A board cannot lift a load without the assistance of a person. A lever also cannot do work on its own. A hammer cannot pull out a nail by itself. But these objects help us to do work.

Any object which makes our work easy is called a machine.

A wooden plank, a hammer or a knife are simple machines. Thus lever and inclined plane are simple machines.

What are other types of simple machines?



Let us observe

Take a knife and observe its edge. It is thick at one edge and thin and sharp at the other edge. When we apply force at the thicker edge, the knife can cut vegetables and other objects.

Go to a carpenter and observe the edge of an axe or a chisel with which he cuts wood. They are thin and sharp at one end and thick at the other end.

Any such instrument is said to have the shape of a *wedge*.

A wedge is also a simple machine because it helps us to cut different objects.

Look at the tip of a nail or a screw. The tip is sharp and pointed but its other end is thick.

The nail or screw is also like a wedge. The nail and screw are also examples of simple machines.

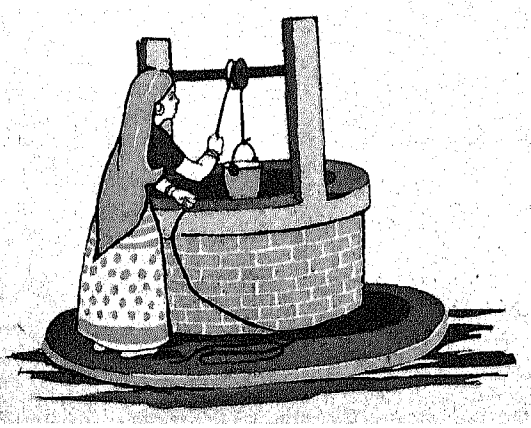
Many birds, like the woodpecker, have sharp pointed beaks. They are also in the shape of a wedge. For what purpose do these birds use their sharp beaks?

You must have seen people drawing water from wells. It is easy to draw water when there is a pulley on the well.

What is a pulley?

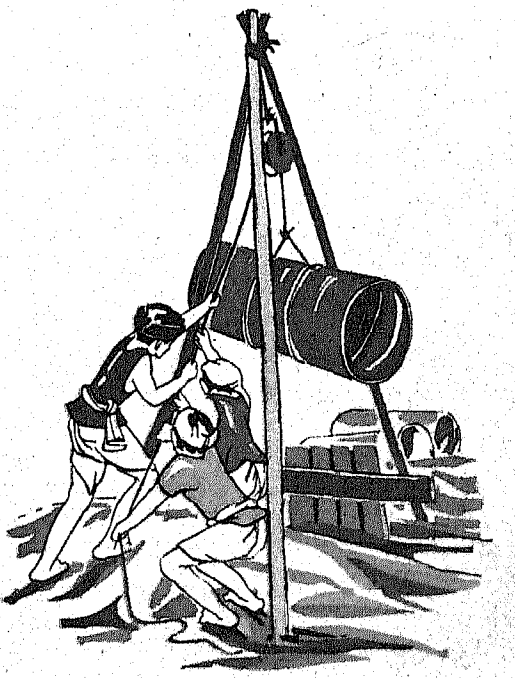
Let us observe

Look at the figure. You can see a woman pulling a rope to draw water. The rope passes over a wheel. The wheel rotates over a rod which is known as *axle*. The rotating wheel is called a pulley.



The pulley helps the woman to draw water easily. The pulley is also a simple machine.

Pulleys are used in many places. They can be seen at construction sites for lifting heavy materials. They can also be seen at railway yards and crossings, and at dockyards for ships.

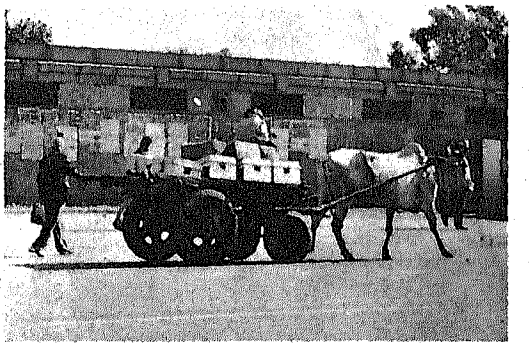


You have seen pulleys being used on wells and in cranes, etc. Try to find out where else they are used. Also

find out the materials they are made up of.

Look at a bicycle, a bullock cart, a wheel barrow or a sewing machine.

Are they simple machines? No, they are not. They consist of many simple

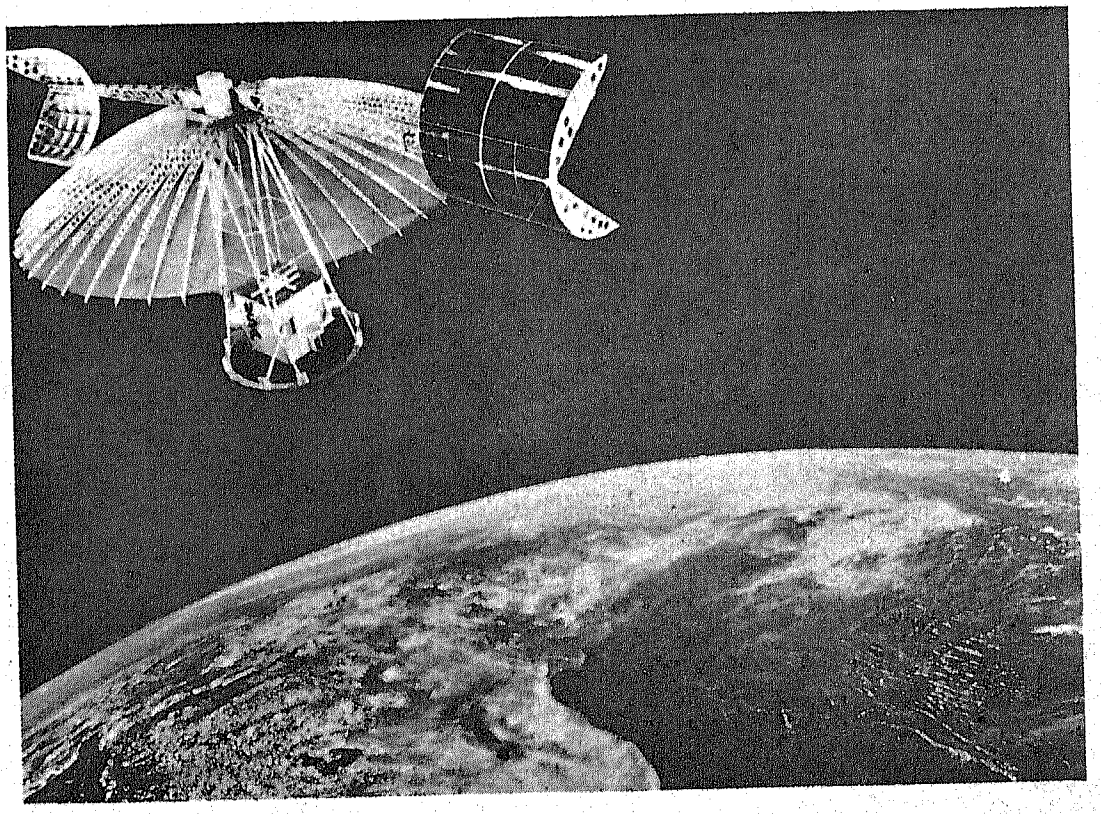


machines like levers, wedges and pulleys.

Try to name a few simple machines that you find in the bicycle, the bullock cart, the wheel barrow and the sewing machine.

CHAPTER EIGHT

The Moon and Satellites



We are all familiar with the moon. We see it in the sky at night. It appears to change its shape from day to day. Sometimes it appears as a full circle. Then it is known as full moon and the light is bright. That is known as *purnima* night. On other nights, the moon either appears as three-fourths of a circle or half a circle or a quarter circle, and the light is less bright. On one night every month, known as *amavasya,* the moon is not visible at all. It happens on the new moon night.

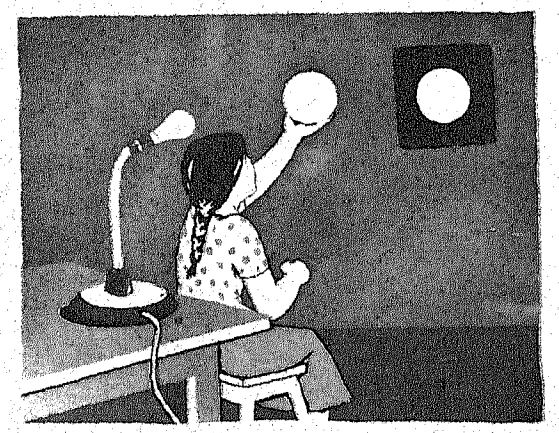
We have studied in Class III that the changing shapes are known as the phases of the moon.

How are the phases of the moon caused?

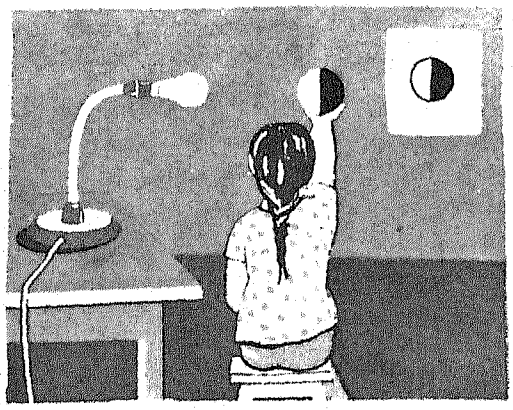
Let us find out

Take a ball and an electric bulb or a torch light. In this activity, you will be the earth. The ball will be the moon and the light will be the sun.

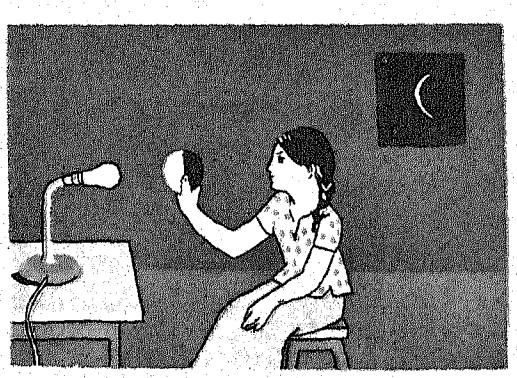
Observe the ball with the light behind you. The side of the ball which is facing the light is lighted up. Draw the picture of the ball. Does the picture look like a circle?



When we see the real moon like a full circle, we call it a full moon. At full moon, you can see the whole of the side facing the sun. You cannot see the other side which always faces away from the earth.



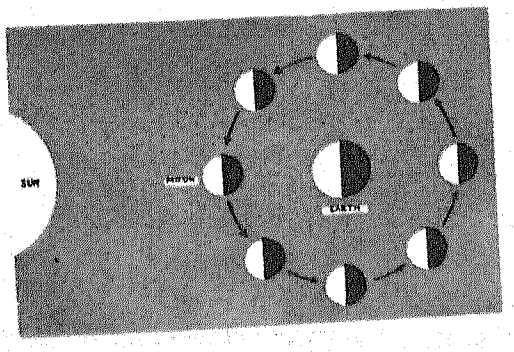
Now move the ball, so that the bulb is on your left side. The sun is shining on the moon but you do not see the full circle of the lighted side of the moon. Draw the lighted portion that you see. You will see only half a circle. This shows the position of the moon on half moon night.



Move the ball again, so that now it is between you and the bulb. Now you will not see the lighted side of the ball. This is the position on the new moon night.

As you continue to move the ball, you will again be able to see half circle and then full circle of the ball.

Thus, we see that the phases of the moon are caused by the revolution of the moon around the earth.



How much time does the moon take to revolve around the earth? How far is the moon from the earth?

Let us discuss

The moon revolves around the earth at a distance of about 3.8 lakh kilometres from us. It takes about 27.3 days to complete one revolution around the earth.

Any object which revolves around a planet is called a *satellite*. The moon is a satellite of the earth because it revolves around the earth. It is the only natural satellite of the earth.

You know that the earth attracts the moon towards it. Then why does the moon not fall down?

Let us find out

Take a string and tie a small stone or a wooden piece at one of its ends. Holding the other end in your hand revolve the string around. The stone does not fall while it is revolving. In the same way, the moon does not fall when it revolves around the earth. Similarly, the planets do not fall towards the sun because they are revolving around it. You have learnt that the moon is the satellite of the earth. Similarly, other planets also have satellites of their own. For example, the planet Jupiter has 12 satellites

Are there artificial satellites also?

Let us discuss

Many countries have sent man-made satellites which go around the earth. The first such artificial satellite called 'Sputnik' was launched by the Soviet Union in 1957. Since then, many other satellites have also been launched.

India launched its first satellite called Aryabhata on 19 April, 1976. This satellite weighed 360 kg and went around the earth sixteen times a day. Its height from the equator was about 600 km.

Artificial satellites are used for

scientific studies, for predicting the weather and also for sending TV and telephone signals. An American satellite called ATS-6 was used for transmitting television programmes to villages in six Indian states (See figure on page 65).

How big is the moon?

Let us discuss

The moon on full moon (*purnima*) night appears almost as big as the sun. But is it really as big as the sun?

The moon is very near the earth as compared to the sun. It is 3.8 lakh kilometres away. But the sun is about 15 crore kilometres away from the earth. Calculate how many times is the distance of the sun larger than the distance of the moon from the earth.

We all know that when we look at a far off object, it appears smaller. The sun is so far away that it appears very small and almost as small as the moon. Actually, the moon is smaller than the sun. It is also smaller than the earth. The size of the earth is about four times the size of the moon.

How can we study the moon? How can we find more about it?

Let us discuss

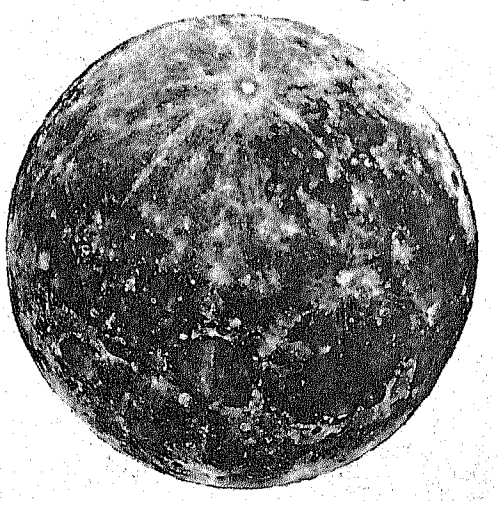
People have been looking at the moon for thousands of years. Scientists have also studied it with the help of telescopes for more than three hundred years.

The photographs of the moon have also been taken by many space ships sent by the USSR and the USA. Men have also landed on the moon to study its surface and soils. The men who go in space ships for scientific studies are called astronauts or cosmonauts. Sometimes, special machines have been landed on the moon. They have taken samples of its soil and rocks and returned to the earth. These soils and rocks are studied to find out more about the moon.

What is the structure of the moon? How does its surface appear when seen from the earth?

Let us observe

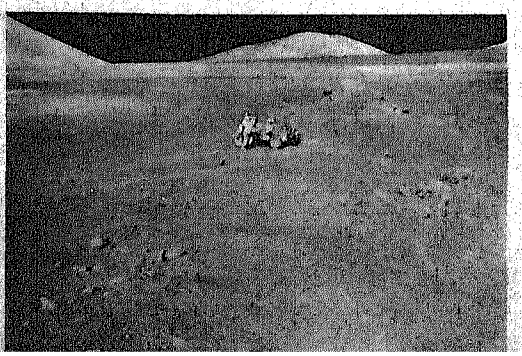
Look at the moon's photograph. It



was taken on full moon night. It shows that its surface has many circular holes or depressions. These are called craters. Some are small and some are very large. The craters have been named after places and people. Some are named after Indian scientists also. These scientists are C.V. Raman, Homi Bhabha, Meghnad Saha, J.C. Bose and others.

Even without a telescope, some dark regions on the surface of the moon can be seen. You can see them in the photograph also. The earlier astronomers thought that the regions which were flat and dark were seas on the moon and called them Maria. We now know that these Maria are huge plains of dark soil with small rocks and craters in them. You can see two Maria in the lower centre of the photograph. They are of circular shape and are very large, having a diameter of more than 700 km.

In addition to these flat surfaces (Maria) and the craters, there are some mountains also on the moon.



Some of the mountains are as big as Mount Everest. These mountains can be seen in the photograph which also shows an astronaut with his moon car on the moon.

Does the moon contain any air or water?

Let us discuss

There is no air or water on the moon. Like the earth, the moon also attracts things through a gravitational force. But the force of attraction on the moon is much smaller (one sixth) than the gravitational force of the earth. That is why gases have escaped from the moon.

Because of this, there is no life on the moon. There are no plants or animals on the moon.

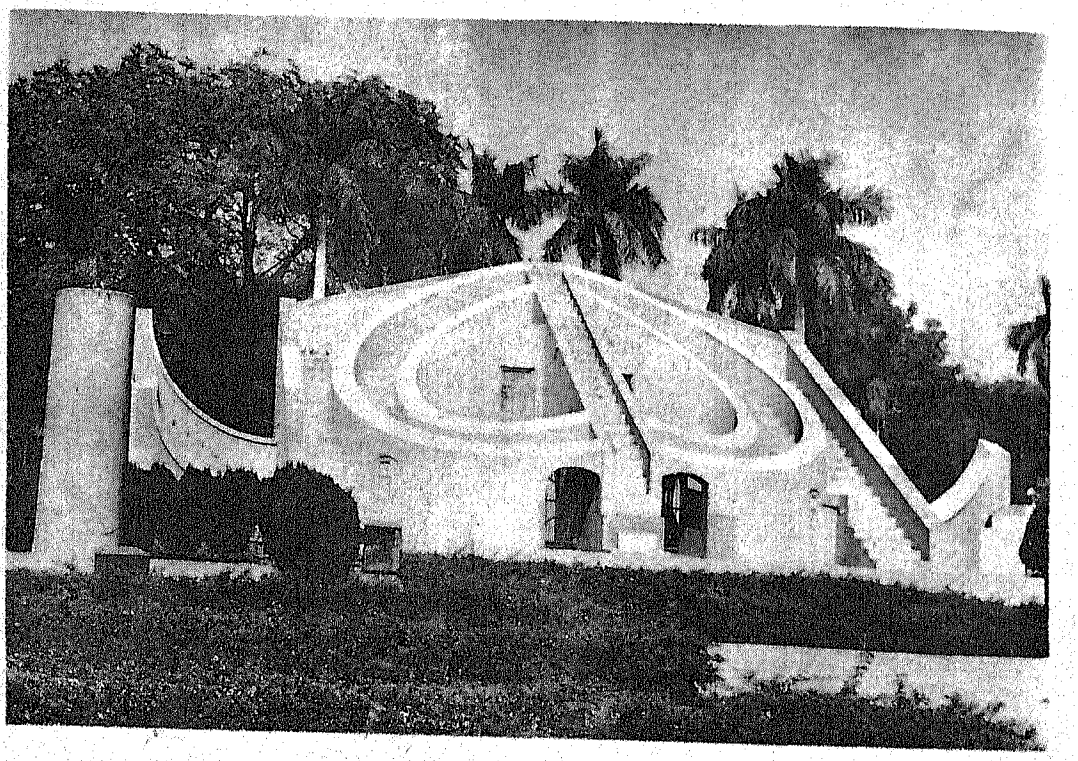
Scientists and the men, who have landed on the moon, have also found that the moon's surface becomes very hot in the day time and very cold at night.

When the astronauts landed on the moon, they wore special suits to protect themselves against the heat and the cold. They also carried cylinders of oxygen for breathing.

Many people would like to go to the moon and have bought tickets for it. Perhaps, one day, you may also go there.

CHAPTER NINE

Shadows and Eclipses



When it is day time, you can see shadows of buildings, trees, people and vehicles. When people or cars move, the shadows also move with them.

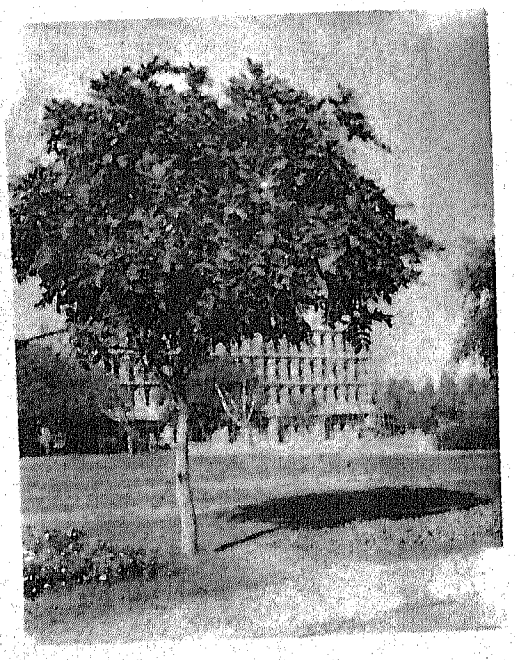
At night also we get shadows. These are caused by the light coming from bulbs or candles etc.

What is the shape of these shadows?

Let us discuss

Let us look at the shadows of animals, cars, trees or buildings.

When we see the shadow of a tree, the shadow looks like the tree which is



producing it. Similarly, the shadow of a house looks like the house. By looking at the shadow, we can find out the object which is making this shadow.

Observe the shadows of a tree and an electric or telephone pole. If the pole is taller than the tree, then the shadow of the pole is longer than that of the tree.

Similarly, the shadow of a building is wider than that of a tree.

How are shadows formed?

Let us find out

Take any object like a lid or a saucer.

Observe its shadow in the sun. Is the shape of the shadow the same as the lid? Yes, it is. The light from the sun that is falling on the saucer is not allowed to pass through and so a shadow is formed. We can also observe that the edges of the shadow are sharp and distinct.

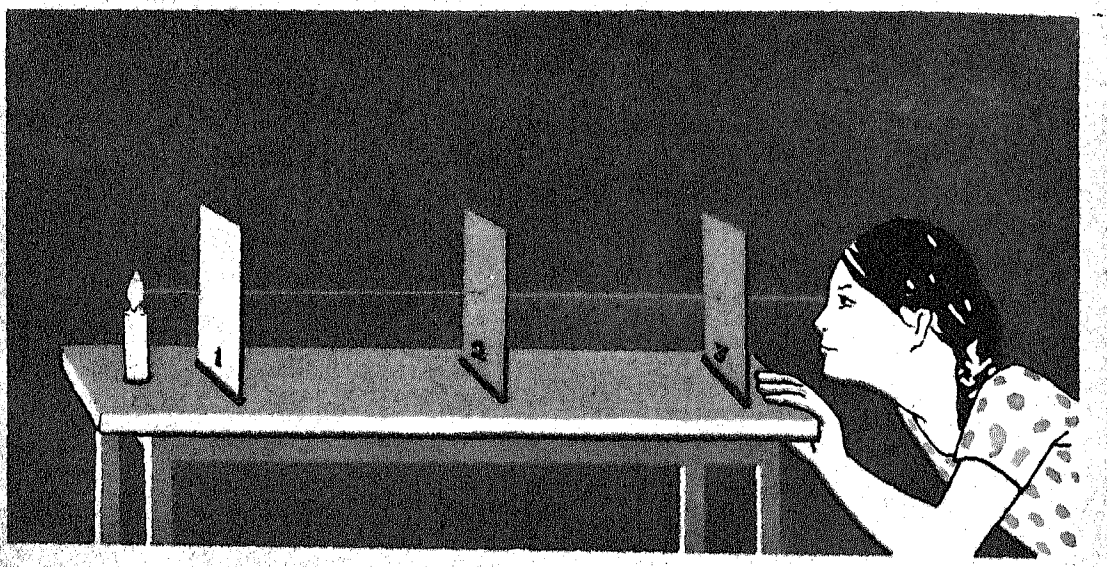
Here we see that the shape of the shadow is similar to the object that produces the shadow.

When we stand outside a room, we cannot see what is happening in the room unless we stand right in front of the door.

Suppose you are talking to your friend, who is sitting in front of you. If another child comes in between you and your friend, can you see your friend?

How can we explain the above observations?

How does light travel from one point to another?



Let us find out

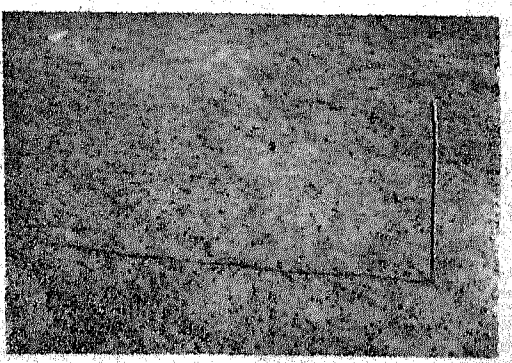
Take three cardboards of the same size and make a small hole with a pin at the centre of each of the cardboards. Light a bulb or a candle and place it near the hole of the cardboard number 1. Now look at the bulb from the hole made in the cardboard number 3. You can see the bulb when the holes are exactly in the same line. But if you disturb one of the cardboards, for example the second board, can you see the bulb? No, you cannot.

This shows that light travels in straight lines.

Does the length of a shadow change during the day?

Let us find out

Take a stick and fix it upright in the



school ground. Otherwise, you may observe the shadow of a pole on the road. Start your activity at eight or nine in the morning. Mark the tip of the shadow with a chalk and measure the length of the shadow. After one hour, again mark the tip of the shadow and measure its length.

Repeat your observations after each hour and try to fill in the table below:

Length of the shadow at different times	*Stick*	*Pole*
8 O' clock		
9 O' clock		
10 O' clock		
4 P.M.		
5 P.M.		

What do you observe? You can see that the length of the shadow first decreases and is the shortest at 12-00 noon. Then it begins to increase in length again. You may also see that the direction of the shadow also changes as the position of the sun changes during the day.

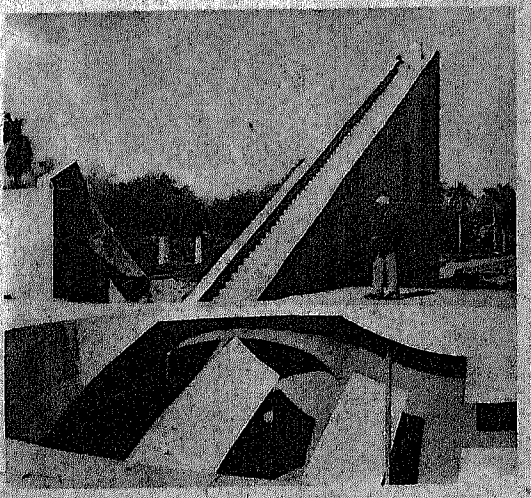
You may observe change in the length of the shadows of an object from season to season.

From the length and direction of the shadow, we can actually tell what time of the day it is. How can we do it?

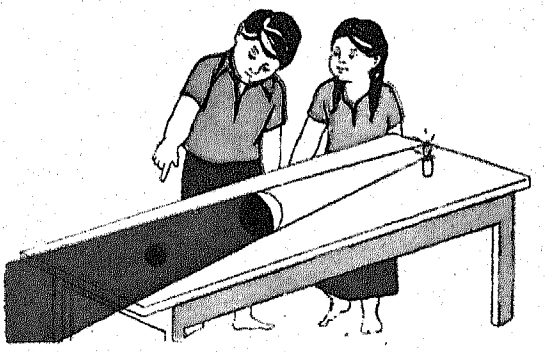
Let us discuss

Next day, when the shadow of the stick is at a particular mark, find out from the table at what time the shadow reached that mark. Then you know what time it is.

This is how time can be found out by means of the sun and the shadow. An apparatus which tells time by the shadow of the sun is called a sun dial.



Some sun dials exist in India to this date. In Jaipur and Delhi there are observatories called *Jantar Mantar,* where you can see the famous sun dials.



Both the Jantar Mantars were built by Maharaja Jai Singh II of Jaipur. He built the Delhi Jantar Mantar in A.D. 1724. They can tell not only the time of the day, but can measure the position of the sun and the planets at different times of the year. These observatories can also help us to know when eclipses of the sun or the moon will take place.

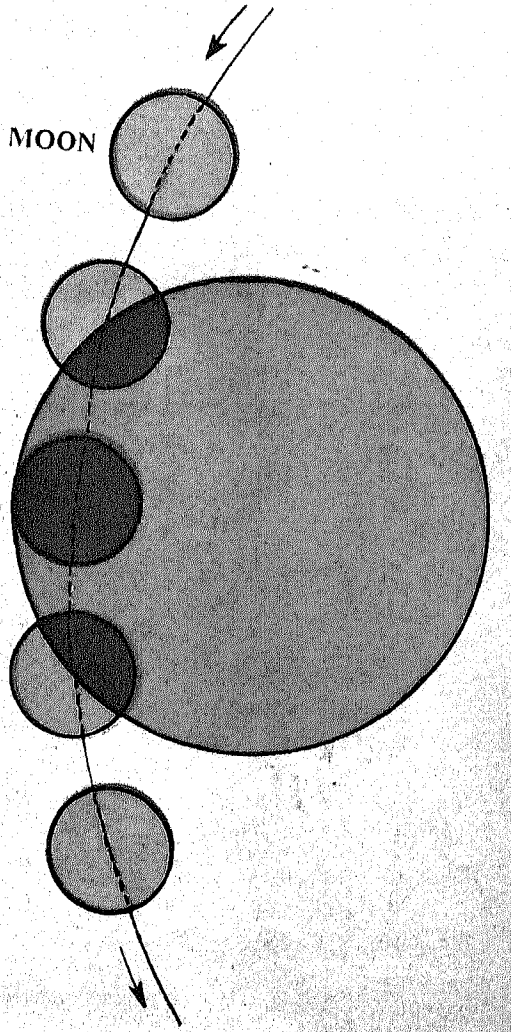
What are eclipses? How are they formed?

How does the eclipse of the moon occur?

Let us find out

Take a torch light or a candle and two balls. One ball should be bigger than the other ball. Do the activity in a room where there is not much light.

Place the big ball on the table. Think of it as the earth. Hold the small ball as shown. This will be the moon. Light the torch or the candle. This is the sun.



Move the small ball (moon) around the big ball. The big ball (earth) will cast a shadow. As the small ball

(moon) moves, it enters the shadow of the big ball. In the same way, the real moon enters the shadow of the earth.

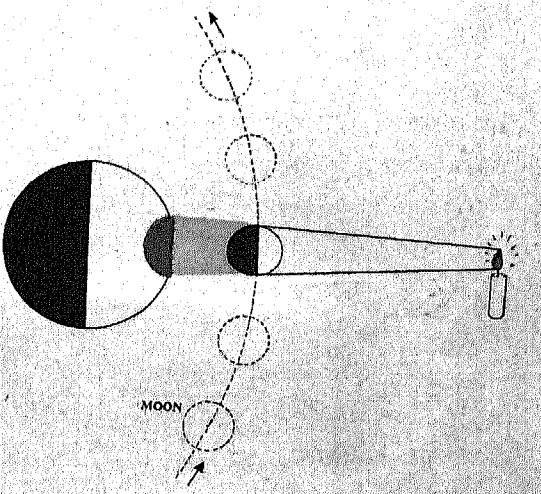
The portion which enters the shadow becomes dark and an eclipse of the moon (lunar eclipse) is formed. When only a part of the moon is in the earth's shadow, we call it a partial eclipse of the moon. As the moon moves about the earth, it sometimes completely enters the shadow of the earth. This is the total lunar eclipse.

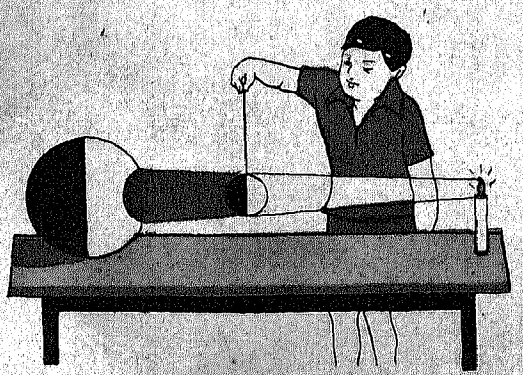
The lunar eclipse occurs when the sun, the earth and the moon are in a straight line and the earth is in the middle. This can happen only on *purnima* (full moon) night.

Is there an eclipse of the sun? How does a solar eclipse occur?

Let us find out

As before, take the two balls and the light of the candle. The big ball is the earth, the small ball the moon and the light the sun. Suspend the small ball (moon) with a string at a distance of about 15 cm from the bigger ball (earth). When the candle is lit, the moon will cast a shadow on the surface of the earth because it will block the light coming from the candle (sun).





Any person who is in the moon's shadow on the earth cannot see the sun. For him there will be an eclipse of the sun. A solar eclipse will occur when the sun, the moon and the earth are in a straight line and the moon is in the middle. This happens on a new moon day.

You should not look at the solar eclipse directly. It may damage your eyes.